MONTHLY WEATHER REVIEW.

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INTRODUCTION.

The MONTHLY WEATHER REVIEW for July, 1904, is based on data from about 3300 stations, classified as follows:

Weather Bureau stations, regular, telegraph, and mail, 167; West Indian Service, cable and mail, 4; River and Flood Service, regular 43, special river and rainfall, 190, special rainfall only, 56; voluntary observers, domestic and foreign, 2565; total Weather Bureau Service, 3025; Canadian Meteorological Service, by telegraph and mail, 20, by mail only, 13; Meteorological Service of the Azores, by cable, 2; Meteorological Office, London, by cable, 8; Mexican Telegraph Company, by cable, 3; Army Post Hospital reports, 18; United States Life-Saving Service, 9; Southern Pacific Company, 96; Hawaiian Meteorological Service, 75; Jamaica Weather Service, 130; Costa Rican Meteorological Service, 25; The New Panama Canal Company, 5; Central Meteorological Observatory of Mexico, 20 station summaries, also printed daily bulletins and charts, based on simultaneous observations at about 40 stations; Mexican Federal Telegraph Service, printed daily charts, based on about 30 stations.

Special acknowledgment is made of the hearty cooperation of Prof. R. F. Stupart, Director of the Meteorological Service of the Dominion of Canada; Mr. R. C. Lydecker, Territorial Meteorologist, Honolulu, Hawaii; Señor Manuel E. Pastrana, Director of the Central Meteorological and Magnetic Observatory of Mexico; Camilo A. Gonzales, Director-General of Mexican Telegraphs; Capt. S. I. Kimball, Superintendent of the United States Life-Saving Service; Lieut. Commander H. M. Hodges, Hydrographer, United States Navy; H. Pittier, Director of the Physico-Geographic Institute, San José, Costa Rica; Commandant Francisco S. Chaves, Director of the Meteorological Service of the Azores, Ponta Delgada, St. Michaels, Azores; W. N. Shaw, Esq., Secretary, Meteorological Office, London; Rev. José Algué, S. J., Director, Philippine Weather Service; and H. H. Cousins, Chemist, in charge of the Jamaica Weather Office; Señor Enrique A. Del Monte, Director of the Meteorological Service of the Republic of Cuba.

Attention is called to the fact that the clocks and self-registers at regular Weather Bureau stations are all set to seventy-fifth meridian or eastern standard time, which is exactly five hours behind Greenwich time; as far as practicable, only this standard of time is used in the text of the REVIEW, since all Weather Bureau observations are required to be taken and recorded by it. The standards used by the public in the United States and Canada and by the voluntary observers are believed to conform generally to the modern international system of standard meridians, one hour apart, beginning with Greenwich. The Hawaiian standard meridian is 157° 30′, or $10^h\ 30^m$ west of Greenwich. The Costa Rican standard meridian is that of San José, $5^h\ 36^m$ west of Greenwich. Records of miscellaneous phenomena that are reported occasionally in other standards of time by voluntary observers or newspaper correspondents are sometimes corrected to agree with the eastern standard; otherwise, the local standard is mentioned.

Barometric pressures, whether "station pressures" or "sea-level pressures," are now reduced to standard gravity, so that they express pressure in a standard system of absolute measures.

FORECASTS AND WARNINGS.

By Prof. E. B. GARRIOTT, in charge of Forecast Division.

Attending the passage over and north of Scotland of a number of disturbances of slight intensity, barometric pressures over the eastern Atlantic were subject to frequent fluctuations. In the vicinity of the Azores prevailing high pressures were broken at intervals by the passage of a disturbance far to the northward, and several disturbances of moderate strength passed from the St. Lawrence Valley over Newfoundland and the North Atlantic in high latitudes.

Over the North American Continent there was a rapid succession of shallow barometric depressions from the British Northwest Territory eastward, some of which moved southeastward over the Missouri Valley and others passed over or north of Lake Superior toward the lower St. Lawrence Valley. No low barometric areas appeared in the Southern States, and but two slight cyclonic disturbances appeared as far south as the Ohio Valley.

The passage of the low areas referred to was attended by frequent rains east of the Rocky Mountains that prevented protracted heat spells. Early in the month heavy rains in the middle-western States caused freshets in the Kansas, lower Missouri, and Arkansas rivers. An additional contributory cause of the moderate temperatures of the month is found in the tracks of high barometer areas, which were confined to the northern part of the country.

The following communication was addressed to the Weather Bureau observer at Shreveport, La., by Mr. S. W. Kerley, Secretary of the Caddo Levee Board:

At a meeting of the Caddo Levee Board held this, the 10th day of August, I was instructed to write you and express the appreciation of the board for the very valuable service rendered the Levee District by your office, in warning the planting interests in the river valley of the danger of high water. As our district has large areas of lowlands unprotected by our levee system, such information as furnished by your office has been invaluable in the past, and especially during the recent high water, and the desire of the Levee Board is to express their appreciation for the services rendered.

WEST GULF FORECAST DISTRICT.

The month was free from disturbances except occasional thunderstorms, and no storm warnings were ordered.—*I. M. Cline, District Forecaster.*

NORTH-CENTRAL FORECAST DISTRICT.

No severe storms occurred during the month, although several disturbances that crossed the Lake region were attended by more or less severe thundersqualls.—*F. J. Walz, District Forecaster and Inspector.*

ROCKY MOUNTAIN FORECAST DISTRICT.

The month was cool; thunderstorms were frequent with copious local rains on the middle-eastern slope and in Arizona, while in New Mexico the protracted drought was only partially relieved. No frost warnings were issued.—*F. H. Brandenburg, District Forecaster.*

SOUTH PACIFIC FORECAST DISTRICT.

The month was not marked by any unusual feature, unless the large number of thunderstorms in the mountains of south-

ern California, Arizona, and Nevada, and the high Sierra during the last decade be considered abnormal. A light rain fell at San Francisco on the morning of the 15th and was forecast on the evening map of the 14th, and was the first rain reported at San Francisco on that date during the last fifty-five years.—*A. G. McAdie, Professor and District Forecaster.*

NORTH PACIFIC FORECAST DISTRICT.

Owing to the frequency of low pressure areas in British Columbia with trough-like extensions reaching south over the eastern portion of this district, numerous thunderstorms occurred in the mountains and foothills of eastern Oregon, eastern Washington, and Idaho, while to the west of the Cascade Mountains rains were infrequent and crops suffered for lack of moisture. The rainfall attending these troughs of low pressure caused damaging floods in ravines and canyons. On the afternoon of the 16th a maximum wind velocity of 60 miles an hour from the southeast occurred at North Head, Wash., for which timely warnings were issued. During this gale the schooner *Zampa* was disabled and drifted ashore near Leadbetter Point early on the morning of the 17th.—*Edward J. Beals, District Forecaster.*

RIVERS AND FLOODS.

Although the Mississippi River fell steadily throughout the month, good average stages were maintained. The lowest stages in the Missouri River were also recorded on the last day of the month; but during the first decade there was a moderate flood over the lower portion, caused mainly by water from the Kansas River. The following report on this flood was prepared by Mr. P. Connor, in charge of the United States Weather Bureau office at Kansas City, Mo.:

Kansas City and the smaller towns near the junction of the Missouri and Kansas rivers escaped a recurrence of last year's flood, with all its disastrous consequences, by a very small margin. As it really happened, there was a flood that caused anxiety and considerable loss, but nothing in comparison with that of last year.

The losses this year were greatly diminished by the promptness and unanimity of action on the part of those interested in the flood warnings. This was in marked contrast with their conduct of last year, when they waited and watched the rising waters until it was too late to save anything.

The flood this year was simply one of a series of climaxes caused by the aggravated conditions that have obtained in this section of the West since spring opened. It covered a very brief period, came up suddenly, passed off suddenly, and was restricted to the extreme eastern portion of the Kansas River and the Missouri at and below Kansas City.

The spring and early summer months, like those of 1903, in Kansas and western Missouri, were abnormally wet. At Kansas City there was an excess of nearly 17 inches of precipitation from March 1 to July 8, the date of highest water. Fortunately for this community and interests below Kansas City, the most violent storms occurred outside the Kansas, commonly known as the Kaw, watershed. The rainfall in the Kaw Valley, while far too heavy and frequent for good farm work, was so distributed that the streams could carry it off without overflowing their banks until July 6, although twice in June rather heavy rains on successive days caused a good many of them to become almost bank full in places.

On the morning of July 4 rather heavy rains were reported throughout the Kaw Valley and northwest Missouri, with the larger streams in the Kaw Valley at ordinary stages. On the morning of July 5 only ordinary rains were reported over the same territory. There was as yet no cause for serious apprehension, but on the afternoon and the night of the 5th uniformly heavy rains fell over the greater portion of the Kaw Valley and northwest Missouri. At Kansas City the fall was 2.31 inches in eighteen hours, and it was equally heavy along the Kaw River to Topeka and along the Missouri to some distance above St. Joseph.

The great quantity of rain that fell in the basin at the junction of the Missouri and Kaw rivers had an immediate effect in raising the rivers at Kansas City, and in consequence the Missouri had risen 2.7 feet by the morning of July 6, placing it 1.1 feet above the danger line. The Kaw River rose 4 to 5 feet.

The following warning was issued on the morning of July 6:

"Heavy rains in the past twenty-four hours in this section have caused the Missouri River to go 1.1 feet above the danger line at Kansas City. The indications are that the Missouri may go 2 feet higher and the Kaw 4 to 5 feet higher by Thursday evening. In the absence of further rains the figures given express the maximum stages anticipated."

The following warnings were mailed to 22 places between Kansas City and Boonville:

"Heavy rains in past twenty-four hours caused a decided rise in the Kansas River and in the Missouri in this locality. A further rise of 2 feet in the Missouri is anticipated, which will place it at 24 feet, 3 feet above danger line. This stage, augmented by the streams below Kansas City is liable to cause damage in low places."

The Kaw River rose rapidly during the 6th, overflowing portions of Argentine and Armourdale, Kans., and the Missouri was getting into the low places in Harlem, opposite Kansas City.

On July 7 the Missouri had risen 1.3 feet by 7 a. m., and the Kaw had risen 4.2 feet by 9 a. m. Weather conditions continued in favor of rain.

The following forecast was issued:

"The Kaw River rose 4.2 feet and the Missouri 1.3 feet in past twenty-four hours. The Kaw will rise about 3 feet and the Missouri about 1.5 feet in the next thirty hours, which, in the absence of heavy rains, should be the crest of the flood. But the rain outlook is very uncertain and great caution should be exercised by all interested. The immediate outlook means that Argentine, Armourdale, Harlem, and the lowlands below Kansas City will be inundated, and will threaten the wholesale district in the west and the east bottoms."

The following message was sent to 17 places between Kansas City and Boonville, all that could be reached by telephone:

"The lowlands between Kansas City and Boonville will be overflowed by Friday night" (July 8).

During the day of July 7 Armourdale, Argentine, Harlem, and the low bottoms were gradually being flooded. But the inhabitants of those cities took warning and began moving their effects on the 6th. Those not having a second story to their buildings in which to store their belongings, moved them to higher ground. Many of the plants in the Kaw bottoms, including the packing houses, stock yards, manufacturing plants, etc., ceased operations. Water entered all the cellars in the west bottoms of Kansas City, and by evening threatened an invasion of the streets. Train service was crippled to the westward.

On July 8 the weather outlook had somewhat improved. The Missouri River at 7 a. m. was 25.2 feet; the Kaw had risen about 3 feet at the stock yards. The forecast this morning was:

"Rivers practically stationary since 4 a. m. to-day. Only slight fluctuations are anticipated, although prospective rains may raise the flood level slightly."

This information was issued before a report from Topeka that a 7 or 8-foot rise had taken place there could be proved erroneous. About 11 a. m. the statement was given out that the immediate outlook favored a slight fall to-night and Saturday (9th) in both rivers.

The local situation on this date was slightly more aggravated, but there was no distress. Business in the bottoms generally came to a standstill. The menacing aspect of a good sized flood always causes alarm and anxiety, yet in this case it was not working material damage except in the interruption to business, the cost of moving goods out of the way, etc.

On the morning of July 9 the Missouri was 24.8 feet, a fall of 0.4 foot. The fall in the Kaw was more pronounced.

The following forecast was issued:

"Both rivers will continue to fall during the next forty-eight hours, the Kaw about 4 feet and the Missouri 2 to 3 feet."

The river conditions and outlook were telephoned to 17 points between Kansas City and Boonville at noon.

On the morning of July 10 the Missouri had fallen 1.4 feet; the Kaw about twice as much. On July 11 the Missouri read 21.9 feet, a fall of 2.9 feet in forty-eight hours, about what had been anticipated.

The forecast issued on the 11th was:

"The Missouri will be within its banks Tuesday and will continue falling in the absence of heavy rains. The Kaw will be within its banks to-night and will continue falling."

On July 12 both rivers were within their banks, and the statement was issued that they would continue falling.

The flood having subsided the inhabitants of the deserted cities moved back, and the wheels of industry once more began to revolve in the west bottoms.

In this community the collective loss was so distributed that it is impossible to make an intelligent estimate. Probably 5000 persons moved their effects to places of safety, and then back again to their homes; railroad traffic was interrupted for four or five days, and roadbeds required some repairs; two temporary bridges across the Kaw were wrecked. The interruption to business and loss of time by the thousands of employees in the big manufacturing establishments, also represent a considerable sum of money,

There were no lives lost.

Between Topeka and Kansas City about one-half the bottom land was overflowed, and about forty per cent of the crops ruined.

Below Kansas City the loss was entirely to the growing crops on the lowlands, and was approximately $400,000 between Kansas City and Boonville.

While the flood was in progress at the eastern end of the Kaw River, there was a moderate flood in the western portion, but fortunately for this community and interests below, the heavy rains were so timed that the highest stage was reached in the western overflow after the crest of the eastern one had passed Kansas City.

From July 6 to 14 the Smoky Hill River and subsidiary creeks overflowed their banks from Salina to Junction City, Kans., the highest water occurring on the 10th. East Salina was overflowed, and about sixty per cent of the growing crops on the bottom land between that place and Junction City were greatly damaged. From east of Junction City to Topeka there was no damage of consequence.

When the volume of water from the overflowed land west of Junction City came on, it had but little effect on the eastern end of the river; in fact it did not wholly check the falling tendency at Topeka.

From July 6 to 12 the Republican River overflowed its banks at Clay Center, the maximum stage occurring on the 7th. Growing corn in the bottoms at Clay Center and in localities below was damaged.

The majority of people here do not realize by what good fortune they escaped another disastrous flood. Seventy per cent of the amount of water that came down last year would have caused as great a flood, owing to the condition of the Kaw channel, which still retains many reminders of the flood of 1903.

The same general rain conditions that caused the Kansas River flood also extended southward through the Arkansas River Valley where similar experiences were encountered, though in a lesser degree. As a matter of fact, practically every stream in the eastern half of the State of Kansas was in flood, with the usual attendant conditions of damage and destruction. At Wichita, the Arkansas River reached a stage of 10.2 feet, 0.2 foot above the danger line, and but 0.8 foot below the great high-water stage of 1877. The river gage was washed away soon after the flood began, and three days before the maximum stage was reached the water was flowing through some of the streets of the city. As the flood tide proceeded beyond the limits of the State of Kansas, the following high stages were reached: Webbers Falls, Ind. T., 25.1 feet, 2.1 feet above the danger line; Fort Smith, Ark., 25.5 feet, 3.5 feet above the danger line; and Little Rock, Ark., 25 feet, 2 feet above the danger line.

As far as could be learned no considerable damage was done by this flood after leaving the State of Kansas, although large areas of lowlands were overflowed.

The stages in the Ohio River and its tributaries were sufficient for all purposes of navigation except in the upper Tennessee, where low water necessitated a suspension of steamboat work for about two-thirds of the month.

Nothing of particular interest relative to the remaining rivers of the country has been observed.

The highest and lowest water, mean stage, and monthly range at 195 river stations are given in Table VII. Hydrographs for typical points on seven principal rivers are shown on Chart V. The stations selected for charting are Keokuk, St. Louis, Memphis, Vicksburg, and New Orleans, on the Mississippi; Cincinnati and Cairo, on the Ohio; Nashville, on the Cumberland; Johnsonville, on the Tennessee; Kansas City, on the Missouri; Little Rock, on the Arkansas; and Shreveport, on the Red.—*H. C. Frankenfield, Professor.*

CLIMATE AND CROP SERVICE.

By Mr. JAMES BERRY, Chief of Climate and Crop Service Divison.

The following summaries relating to the general weather and crop conditions during July are furnished by the directors of the respective sections of the Climate and Crop Service of the Weather Bureau; they are based upon voluntary reports from meteorological observers and crop correspondents, of whom there are about 3000 and 14,000, respectively:

Alabama.—Weather generally favorable for crop growth, except excessive and slightly damaging rains in scattered localities, and hailstorm in Coffee County destroyed crops over an area 4 by 14 miles. Cotton fruited well and was quite promising at the close of the month, though wet weather then caused too rapid growth; bolls began opening about the 20th; first bale marketed 26th. Corn and minor crops did well; some early corn matured during last decade. Large crop of late peaches were marketed.—*F. P. Chaffee.*

Arizona.—Temperatures averaged slightly below normal during July. Droughty conditions continued to prevail over most of the Territory during the first two decades, but during the third decade good rains fell over most of the Territory. During the drought crops, except in the lower Colorado Valley, were in very poor condition, and the condition of cattle was deplorable. The rains, however, revived the growth of vegetation and started grass on the ranges, and by the end of the month both cattle and crops had improved greatly.—*M. E. Blystone.*

Arkansas.—The temperature was below normal and the rainfall slightly in excess. Cotton made satisfactory growth and was fruiting nicely by the close of the month; some was laid by grassy. Early corn made a good crop; the late planted was promising. Harvest of wheat and oats was completed and thrashing begun; yields were satisfactory, quality medium. Some hay saved. Late potatoes were planted and came up to good stand; sweet potatoes promising. Apples fair crop; peaches good. Stock healthy.—*Edward B. Richards.*

California.—The abnormally cool weather during a greater part of July retarded the development of crops to some extent. Severe thunderstorms, accompanied by heavy rains, occurred in the mountains of southern California, and two lives were lost by lightning. Grain harvesting and thrashing were nearly completed, the crop below average in yield and quality. The hay crop was unusually heavy and of excellent quality. Deciduous fruits were not yielding the large crops expected. Grapes were giving promise of one of the largest yields for several years.—*Alexander G. McAdie.*

Colorado.—Month was favorable. Harvesting of winter wheat was practically finished; crop generally good, except in northeastern counties. Harvesting of spring grain was begun; good crops, but considerable rust in spring wheat. Corn and second crop of alfalfa made good growth. Ranges good, except in south-central counties. Cutting of native hay was begun. Potatoes and beets were excellent. Heavy crops of raspberries, cherries, and apricots marketed. Apples and peaches coming in. Melons late, but promising.—*F. H. Brandenburg.*

Florida.—Comparative cool, dry weather was favorable for work. Corn suffered during the early part of the month over a portion of the State for rain, and the early planting greatly deteriorated. Cotton pushed forward, though the weed was smaller than usual, plants fruited very well and were generally free of insects. Citrus fruits over a portion of the belt suffered for rain early in the month. The pineapple crop was harvested, the yield was short.—*A. J. Mitchell.*

Georgia.—July was the fourth consecutive month with temperature below normal and the tenth with deficient rainfall. The distribution of rainfall over the district was very irregular, but no damaging drought occurred except in a few widely scattered localities. Crops generally were in excellent condition at the close of the month. Cotton made good growth, plants bloomed and fruited well and bolls began opening in the extreme south about the 25th. The commercial output of peaches was large.—*J. B. Marbury.*

Idaho.—A pronounced warm period occurred from the 20th to the 27th; marked cool periods were from the 13th to the 16th and on the 29th and 30th, the latter culminating in light frosts in elevated districts, doing little damage. Some injury was caused by drought, but crops in general made satisfactory progress. In most instances the range afforded ample subsistence for stock. Water for irrigation held out well.—*Edward L. Wells.*

Illinois.—Corn maintained a good condition throughout the month; at the end of the month the crop was mostly in tassel, and some fields were earing. Oats were practically all cut and considerable thrashing had been done during the third decade. Wheat harvesting was hindered somewhat by wet weather, but the crop was secured generally in good condition. Favorable weather for curing hay prevailed.—*Wm. G. Burns.*

Indiana.—The nights were abnormally cool. The precipitation was deficient during the last week. Corn was mostly laid by during the last decade and was looking well. Wheat harvest was finished about the 20th; yield very light, quality poor. Oats were harvested and clover hay made during the last half of the month; good crops were secured. Cutting timothy was under way at the end of the month. Apple and pear trees suffered from blight, and fruit prospects were materially lessened.—*W. T. Blythe.*

Iowa.—This was the coldest July since 1891, when the State average was 68.6°. Excessive rainfall from 2d to 15th developed rust in small grain, causing much damage to spring wheat. Latter half of month was drier and favorable for harvesting operations. The corn crop was laid by a week later than usual, but made fair progress during warmer period of the month. Conditions were favorable for potatoes, apples, and minor crops.—*John R. Sage.*

Kansas.—Wheat and oat harvests completed under difficulties, owing to wet weather. Wheat yield greater than expected, quality below average. Oats light. Corn improved rapidly, and was earing well in the central counties and tasseling in the northern; corn planted in the river valleys after the last flood grew rapidly. A good crop of tame hay was secured. Second crop of alfalfa generally stacked and was a good crop. Apples dropped badly in several counties. Peaches a good crop.—*T. B. Jennings.*

Kentucky.—The temperature and precipitation were slightly less than normal. Showers were irregularly distributed; some localities had too much rain, while others were suffering from drought at close of month. Wheat was harvested with yield and quality better than expected, Oats

and rye turned out well and hay gave a fair yield. Corn and tobacco made good growth, but in many places needed rain.—*H. B. Hersey.*

Louisiana.—Ideal growing weather prevailed during the early part of the month, but frequent showers toward the close of the month interfered with the cultivation of cotton, and weeds and grass spread rapidly; some complaints of shedding and rust were received. Cane was laid by in good condition, and the weather was all that could be desired for development and substantial growth. Rice harvest was under way at the close of the month. Corn was maturing slowly.—*I. M. Cline.*

Maryland and Delaware.—July was highly favorable for all growing crops, but frequent rains made harvest difficult. A large crop of hay was secured. Wheat yielded from poor to good; oats very good. Corn was very promising and tobacco mostly fine. Pasturage continued abundant. Early potatoes, plums, pears, and cherries were plentiful, and tomatoes and sugar corn promising. Fall plowing was general during the last half of the month.—*Oliver L. Fassig.*

Michigan.—The weather conditions were very favorable for haying and harvest work, but too dry for the best maturity of oats and the growth of corn, potatoes, and beans. Wheat, rye, barley, and hay were generally well secured. Wheat seeding germinated nicely and made fair growth. Sugar beets continued promising. Corn growth was slow and the crop continues backward. The general prospect of apples, plums, and grapes was good at the close of the month.—*C. F. Schneider.*

Minnesota.—Showery early in month, but fine in latter half. On northern lowlands wheat, oats, and barley poor and late; elsewhere these crops were excellent and were heading early in the month, with cutting of rye, barley, and oats begun about 15th, and early spring wheat ripening at end of month. Flax good, but somewhat backward. Corn backward, but improved rapidly with warmer weather late in month. Large clover and timothy crops secured in good condition.—*T. S. Outram.*

Mississippi.—Cotton was generally very promising, although too much rain caused grassy fields and too rapid growth on lowlands; on uplands the crop developed finely and by the close of the month was fruiting well. Early corn matured nicely and late corn was promising, although somewhat damaged by too much moisture on lowlands. Sugar cane, sorghum, peas, potatoes, and melons did remarkably well. Pastures and meadows were in fine condition. Peaches made splendid yield.—*W. S. Belden.*

Missouri.—The first part of the month was rather wet and cool for best results; the last fifteen days gave sufficient sunshine, but nights continued cool. Corn, which was uneven, suffered from an excess of rain, especially in the western portion, and during the latter part of the month the crop was in need of moisture in the central portion. The bulk of wheat, oats, and hay was secured in good condition. The latter half of the month was very favorable for harvesting and haymaking.—*George Reeder.*

Montana.—Temperature conditions were generally favorable for growth, there being but one or two brief periods cool enough to have a retarding effect. Drought prevailed over several northern counties, drying up the range and damaging dry land crops. Cattle and sheep were in thriving condition, except in the drought stricken sections, where water became scarce the last two weeks. The month was exceptionally favorable for haying. Winter wheat harvest commenced the last week. All irrigated crops made satisfactory growth.—*R. F. Young.*

Nebraska.—The harvest commenced about two weeks later than usual, but, with exceptionally favorable weather conditions, was practically uninterrupted, and rye, barley, wheat, and oats were secured with little or no damage during the harvest. Thrashing began about the middle of July, and wheat and oats were found to be considerably damaged by rust and blight. Corn, although it tasseled about ten days late, made a good growth and was very promising at the end of the month.—*G. A. Loveland.*

Nevada.—The weather conditions throughout the month were favorable to growing crops and for harvesting hay and grain. Irrigation water was more plentiful than usual in all districts. Haying progressed without interruption from rains or winds, and from one to three crops of alfalfa were cut and stacked in excellent condition. Grain, potatoes, garden truck, and fruit did well. Range stock did well, the feed being generally fine and abundant in nearly all sections.—*J. H. Smith.*

New England.—The weather of the month was very pleasant, with sunshine above the average. With a few exceptions, the temperature was somewhat deficient in all sections. The rainfall was generally below the average and irregularly distributed. The weather was very favorable to crops, except too dry in parts of Maine and New Hampshire, and they were generally in good condition.—*J. W. Smith.*

New Jersey.—The month was especially noted for its frequent and heavy thunderstorms, which greatly delayed the harvesting of grain and hay; all truck crops at the close of the month were in fine growing condition; orchard fruit, except peaches, were fairly promising in places. Keifer and Bartlett pears promised an average yield.—*Edward W. McGann.*

New Mexico.—First half of the month was mostly dry and crop growth slow and backward, and in western half crop, stock, range, and water conditions were becoming serious. Beneficial showers during last half caused marked improvement. Additional planting was done and harvest of wheat, oats, and second crop of alfalfa was well under way. Field crops, gardens, and fruits improved greatly. Water holes and streams were renewed, range grasses revived, and cattle, horses, and sheep were gaining rapidly at close of month.—*Charles E. Linney.*

New York.—The month as a whole was favorable for agricultural interests, the week ending on the 18th being the most favorable of the season. Corn gained very rapidly, and buckwheat, potatoes, beans, oats, and barley were promising at the close of the month; some oats were cut; wheat and rye harvested, light yields. Hops, tobacco, and sugar beets made rapid progress, and some tobacco was topped. Haying nearly finished, large yield. Peaches and pears very light, but apples and grapes promising.—*R. G. Allen.*

North Carolina.—Temperatures were favorable for crop growth. The rainfall was heavy in south-central counties and insufficient in eastern section till the 27th. All crops laid by. Corn was silking and tasseling early part of month and attained excellent growth. Cotton was blooming and fruiting freely, stands were good. It was growing too fast in southern counties and was shedding slightly. Topping tobacco finished and curing became general, crop below average. Fruit prospects were fair, excepting apples.—*A. Wiesner.*

North Dakota.—Generally cool weather, with very unevenly distributed precipitation prevailed during the month. The cool weather was quite favorable for maturing wheat, oats, rye, and barley, but retarded the growth of corn and flax. Heavy rainfall in the lower Red River Valley did considerable damage to crops in that section, while a deficiency in the western portion of the State was not beneficial to crops there. Haymaking was in progress most of the month, and a large crop of excellent hay was secured.—*B. H. Bronson.*

Ohio.—Temperatures averaged below normal. Precipitation was above normal in the northern and middle and below in the southern sections. Wheat badly affected by rust and the yield was light. Fall plowing was begun the latter part of the month. Oats made rank growth and a large yield was expected. Corn very uneven; considerable damage by high winds and rain of 7th and 28th reported. Hay crop secured in good condition. Rye and barley made good progress. Apples poor; other fruits fair to good.—*J. Warren Smith.*

Oklahoma and Indian Territories.—Wheat damaged to some extent by wet weather, thrashing progressed with poor to fair yields. Early corn matured, late made rapid growth, and promised good yield, except local damage by hot winds, Cotton bloomed, bolled, and fruited well. Kafir and broom corn, cane, millet, milo maize, and castor beans did well. Early potatoes gathered, yield good, late planted coming up. Haying progressed with good yield.—*C. M. Strong.*

Oregon.—Beneficial showers occurred in the eastern portion of the State, but west of the Cascades droughty conditions prevailed and vegetation made slow growth. Harvesting advanced rapidly and haying was completed. Thrashing began during the last decade and the yield of fall wheat was above the average. Early sown spring wheat and oats turned out better than expected. Pasturage generally short except in the mountains. Brush fruit was plentiful and apples promised well.—*Edward A. Beals.*

Pennsylvania.—Coolest July since 1895. Precipitation fairly well distributed. Owing to large acreage winter killed, wheat and rye crops will be less than average. Major portion of heavy yield of hay secured in good condition. Tobacco thrifty, considerable Havana seed ready to cut. Pasturage ample. Many corn fields in tassel. Potatoes and garden truck abundant. Early oats being harvested and late maturing rapidly. Pears and plums plentiful. Peaches scarce. Apples larger and better quality than anticipated. Buckwheat making rapid advance and plowing begun.—*T. F. Townsend.*

Porto Rico.—The dry weather that began in June continued until the last week in July, causing some loss of small crops and delaying planting in places. Cane suffered from the protracted dry spell, especially in the southern division, where there was some loss on land not irrigated. Many plots of early sown rice were lost, but that sown late looked well. Coffee began to mature and a few berries were picked. Mangoes, pineapples, alligator pears, bananas, and plantains were plentiful.—*E. C. Thompson.*

South Carolina.—Practically normal temperature and well distributed, generally copious precipitation caused a healthy, vigorous, sustained growth of all crops. Cotton fruited heavily and was unusually free from disease and injurious insects. Early corn came to maturity. Tobacco developed into a fine quality of leaf; curing operations made rapid progress. Water for flooding rice was scarce early in the month, but became available by its close. Crops were laid by in a well cultivated condition, unusually free from grass and weeds.—*J. W. Bauer.*

South Dakota.—The conditions were generally favorable for oats, rye, barley, spelt, potatoes, grass, millet, and garden stuff. Cutting of rye, barley, spelt, and early oats was far advanced, promising satisfactory yields. In the third decade, when harvest began, rust affected a previously promising spring wheat crop, and in the James River Valley seriously damaged it, except the macaroni. Corn, though healthy, was somewhat backward. The early was earing well by the 31st. Haying advanced favorably, with good returns. Early potatoes gave good yields. Flax did nicely.—*S. W. Glenn.*

Tennessee.—Frequent showers occurred over most of the State, but in scattered places the rainfall was insufficient. Generally, the conditions were very favorable to corn, cotton, tobacco, peas, millet, and garden truck. Wheat proved to be a good crop; oats and hay fine. Corn, at the close of the month, promised the largest crop for years, and cotton

SUMMARY OF TEMPERATURE AND PRECIPITATION BY SECTIONS, JULY, 1904.

In the following table are given, for the various sections of the Climate and Crop Service of the Weather Bureau, the average temperature and rainfall, the stations reporting the highest and lowest temperatures with dates of occurrence, the stations reporting greatest and least monthly precipitation, and other data, as indicated by the several headings.

The mean temperatures for each section, the highest and lowest temperatures, the average precipitation, and the greatest and least monthly amounts are found by using all trustworthy records available.

The mean departures from normal temperature and precipitation are based only on records from stations that have ten or more years of observation. Of course the number of such records is smaller than the total number of stations.

Section.	Temperature—in degrees Fahrenheit.							Precipitation—in inches and hundredths.					
	Monthly extremes.							Greatest monthly.		Least monthly.			
	Section average.	Departure from the normal.	Station.	Highest.	Date.	Station.	Lowest.	Date.	Section average.	Departure from the normal.	Station.	Amount.	Station.	Amount.
Alabama	79.6	— 1.8	Newbern	103	2	Riverton	54	25	4.80	+0.11	Prattville	9.17	Delmar	1.80
Arizona	81.0	— 1.9	Mohawk Summit	118	11	Flagstaff	35	13	2.07	+0.48	Grand Canyon	6.00	2 stations	0.00
Arkansas	77.9	— 2.0	Jonesboro	104	30	Oregon	49	24	4.43	+0.31	Elon	9.56	Newport No. 1	1.06
California	72.2	— 2.4	Volcano Springs	117	11	Bodie	23	16	0.09	+0.02	Bodie	2.83	About three-fifths	0.00
Colorado	64.4	— 2.6	Lamar	102	15	Wagonwheel Gap	23	13	2.09	+0.02	Sheridan Lake	7.38	Delta	0.08
Florida	80.2	— 1.2	Orange City	101	7	Stephensville	57	9	6.35	—1.12	Sumner	15.04	Key West	1.40
Georgia	79.0	— 0.9	Fleming	104	20	Clayton	49	26	3.81	—1.89	Savannah	13.14	Butler	1.10
Idaho	66.5	.....	Lewiston, Payette	105	21	Chesterfield	26	30	0.99	.....	Roosevelt	3.28	Vernon	T.
Illinois	73.2	— 2.8	Peoria	104	17	Lanark	35	2	4.70	+0.97	Cambridge	10.39	Paris	1.57
Indiana	73.0	— 2.6	Fort Wayne	100	16	Fort Wayne	38	2	2.95	—0.51	Evansville	7.98	Madison	0.66
			Hector	100	17									
Iowa	70.6	— 3.6	Marshalltown	100	17	Fayette	38	2	4.41	+0.18	Thurman	11.97	Plover	1.28
Kansas	75.6	— 2.8	Lakin	103	15	Harrison	46	6	6.41	+2.66	Fall River	12.93	Dodge	1.71
Kentucky	75.2	— 2.0	Bardstown	99	18	Loretto	46	3	3.40	—0.70	Mayfield	6.93	Falmouth	0.96
			Cadiz	99	31									
Louisiana	79.9	— 1.9	Minden	100	1	Minden	56	24	7.17	—1.83	Schriever	11.67	Shreveport	2.89
Maryland and Delaware	73.5	— 2.4	Boettcherville, Md.	102	18, 31	Deer Park, Md.	35	8	5.22	+1.40	Mount St. Marys, Md.	8.32	Grantsville, Md.	1.93
Michigan	66.5	— 1.8	Gladwin	99	18	Humboldt	32	7, 8	2.97	—0.34	Wasepi	8.27	Alpena	1.04
						Wetmore	32	7						
Minnesota	66.0	— 3.6	New Ulm	96	16	Beardsley	34	2	3.96	+0.44	New London	9.15	Crookston	2.02
			Wabasha	96	16	Pokegama Falls	34	28						
Mississippi	78.6	— 2.2	Okolona	102	30	Batesville	53	25	6.72	+1.46	Bay St. Louis	13.57	Okolona	2.25
Missouri	74.2	— 3.3	Princeton	100	17	Montreal	47	24	4.65	+0.42	Mount Vernon	10.81	Willow Springs	1.63
			Protem	100	14, 15									
Montana	65.7	— 0.1	Chinook	103	22	Grayling	25	30	1.10	—0.45	Lewistown	3.45	Wibaux	T.
Nebraska	71.1	— 3.3	Bartley	104	16	Alliance	36	6	4.44	+0.99	St. Libory	11.53	Beaver City	0.83
Nevada	68.7	— 1.8	Eureka	110	22	Potts	30	10, 11	0.51	—0.01	Palmetto	3.82	3 stations	0.00
			Hartford, Conn	98	19	Van Buren, Me	39	4, 23						
New England*	68.6	— 1.1	North Grosvenor Dale, Conn.	98	20	Grafton, Stratford, N. H.	39	4	2.95	—0.92	Derby Line, Vt.	6.54	Jacksonville, Vt.	0.78
New Jersey	72.3	— 1.7	Bridgeton	98	19	Charlotteburg	42	4, 14	4.87	—0.14	Plainfield	8.06	Charlotteburg	2.41
New Mexico	72.4	— 1.0	Alamogordo	105	27	Winsors	31	8	1.90	—0.58	Las Vegas	4.95	Fruitland	0.03
			San Marcial	105	29									
New York	68.1	— 1.8	Elmira	99	19	Paul Smiths	34	30	4.59	+0.52	De Ruyter	9.62	Chatham	1.53
North Carolina	75.9	— 1.8	Mount Airy	103	20	Lincolnton	40	26	5.51	—0.04	Horse Cove	3.85	Waynesville	2.17
						Linville	40	31						
North Dakota	64.4	— 3.6	Medora	102	15	Minto	34	28	2.49	—0.38	Walhalla	7.65	New England City	0.10
Ohio	71.4	— 2.6	Findlay	99	17	Hillhouse	41	32	4.13	+0.22	Gratiot	9.57	Cincinnati	0.80
						Akron	41	4, 5						
Oklahoma and Indian Territories.	79.6	— 0.9	Frederick, Okla.	104	12	Pawhuska, Okla.	51	6	3.86	+0.21	Pawhuska, Okla.	10.25	Ravia, Okla.	0.62
Oregon	66.0	+ 0.4	Grants Pass	107	20	Bend	24	29	1.32	+0.75	Bay City	3.45	Arlington	T.
			Blalock, Pendleton	107	21									
Pennsylvania	70.6	— 1.3	Lock Haven	99	18	Smethport	34	3	4.68	+0.38	Doylestown	9.19	Lansdale	1.92
Porto Rico	78.5	.....	Cayey	98	15	Adjuntas	56	12	5.30	.....	Mayaguez	16.07	Guanica Central	0.96
South Carolina	79.4	— 0.5	Sumter	105	7	Walhalla	50	24	5.96	+0.71	Cheraw	14.38	Clemson College	1.44
			Gaffney	105	19									
			Aiken, Seivern	105	20									
South Dakota	68.7	— 3.7	Armour, Chamberlain.	102	29	Ramsey	36	23	2.67	—0.16	Marion	6.16	Fort Meade	0.40
			Leslie	102	15									
Tennessee	75.4	— 2.0	Maryville	100	19	Erasmus	45	26	3.78	—0.41	Florence	6.74	Sewanee	1.21
						Silver Lake	45	31						
Texas	81.2	— 1.5	Bowie	109	12	Graham	53	9	2.70	—0.16	Huntsville	7.80	2 stations	0.00
Utah	69.7	— 2.6	Green River	109	25	Woodruff	27	30	0.68	+0.10	Pinto	3.25	3 stations	T.
Virginia	73.5	— 2.8	Newport News	100	6	Burkes Garden	38	3	4.83	+0.28	Columbia	9.01	McDowell	1.51
Washington	66.2	+ 0.2	Zindel	108	20	Bellingham	35	24	0.97	+0.13	Clearwater	4.33	Lakeside	T.
						Cusick	35	19						
West Virginia	71.5	— 1.3	Martinsburg	97	19	Terra Alta	42	3	3.28	—1.48	Upper Tract	6.00	Leonard	1.04
Wisconsin	67.1	— 3.4	Darlington	103	17	Butternut, Hayward	36	28	3.52	—0.72	Berlin	8.63	City Point	0.94
Wyoming	62.9	— 2.9	Fort Laramie	99	15	Freedom, Wells	25	30	1.27	—0.05	Grand Canyon, Y. N. Park.	4.30	Border	0.12

* Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, and Connecticut.

and tobacco were doing well. The apple crop was generally good; peaches fair to good.—*Roscoe Nunn.*

Texas.—The rainfall conditions were favorable during the first half of the month, but after the 15th the western two-thirds of the State began to feel the need of rain and all crops in the north-central counties suffered from drought. Temperature conditions were generally favorable. Cotton did exceptionally well during the first half of the month, but during the latter half growth was generally slower in the western two-thirds of the State. The plants fruited nicely. The fields were kept well worked out and cultivation was completed the latter part of the month. At the close of the month a few bolls were opening in all sections and a number of bales had been picked in the more southerly counties. Boll weevils caused considerable damage in a number of southwestern and central counties. Boll worms were generally present in the central division, but damage by this pest was confined to limited areas. Late corn generally suffered from drought and will make a short crop. Rice did well and the early sown was heading nicely the latter part of the month. Sugar cane made good growth. The hay crop was unusually heavy and most of it was saved in fine condition. Ranges and pastures continued to furnish plenty of feed for stock.—*L. H. Murdoch.*

Utah—Temperature averaged below normal and precipitation above. Local damage by wind and hail reported. Crops matured rapidly. Lucerne was cut twice with good yields. Fall grain was cut and spring grain ripening. Thrashing was general with splendid returns, especially on arid farms. Beets were very fine. Corn was earing well. Potatoes were setting satisfactorily. Apricots, peaches, and early apples of superior quality were abundant. Berry season declining. Pasturage plentiful and stock thriving. Water was generally sufficient.—*R. J. Hyatt.*

Virginia.—The general weather conditions were favorable for crop progress. Field work consisted mostly of harvesting and thrashing winter wheat and oats, haymaking, working tobacco, and beginning fall plowing. Corn and tobacco were in a very promising condition, the former indicating a large yield and the latter very good returns for the

acreage set out. Pastures were excellent all the month. The prospect for fruit, especially apples, was poor.—*Edward A. Evans.*

Washington.—The rain of the month was poorly distributed. It was copious in the eastern tier of counties during the first three to five days and during the period from the 14th to the 18th, having a beneficial influence on spring wheat and vegetables. A drought prevailed in the western division until the 14th, when general rains began, lasting four days. In the west, pastures were dried up and the potato crop shortened. The oat crop was also light, owing to drought.—*G. N. Salisbury.*

West Virginia.—The weather during July was favorable for crops, but harvesting was somewhat retarded by showers. Corn made rapid growth. Wheat and rye were harvested with poor yields. Haying was in progress during the last week, but the crop was smaller than expected. Oats were promising and some were being cut. Millet, cowpeas, gardens, pastures, and buckwheat were doing well. The prospects were that apples and peaches would make about a half crop and that grapes would be abundant.—*E. C. Vose.*

Wisconsin.—Although the month was cool, all crops, except corn, made substantial advancement. Winter wheat and rye reached maturity about the middle of the month, and oats, barley, spring wheat, and rye were ready for cutting at the close. Corn made slow growth on account of cool nights. The hay crop was heavy and generally secured in good condition. Tobacco was generally backward. Apples and cranberries were in promising condition at the end of the month.—*W. M. Wilson.*

Wyoming.—Cool, with frosts on the 7th and damaging frosts on the 30th over the western sections. Good rains were quite general during the first half of the month. Range grass was mostly cured, with an excellent stand. Grain and gardens not injured by frosts made good growth. A good first crop of alfalfa was secured. Native hay harvest was in progress; good crop. Good flow in streams, and irrigation water sufficient for needs. Stock in excellent condition.—*W. S. Palmer.*

SPECIAL ARTICLES.

RECENT PAPERS BEARING ON METEOROLOGY.

Mr. H. H. KIMBALL, Librarian and Climatologist.

The subjoined titles have been selected from the contents of the periodicals and serials recently received in the Library of the Weather Bureau. The titles selected are of papers or other communications bearing on meteorology or cognate branches of science. This is not a complete index of the meteorological contents of all the journals from which it has been compiled; it shows only the articles that appear to the compiler likely to be of particular interest in connection with the work of the Weather Bureau. Unsigned articles are indicated by a ——.

American Journal of Science. New Haven. 4th Series. Vol. 18.

Lester, O. C. On the Oxygen Absorption Bands of the Solar Spectrum. Pp. 147–156.

Electrical World and Engineer. New York. Vol. 44.

—— Sir Oliver Lodge on Electricity. P. 164.

Collins, A. Frederick. Synthetic Wireless Telegraphy. Pp. 174–175.

—— Wildman Wireless Telegraph System. P. 184.

Proceedings of the American Philosophical Society. Philadelphia. Vol. 43.

Haupt, Lewis M. The Mississippi River Problem. Pp. 71–96.

Abbott, Charles Conrad. One Explanation of Reported Showers of Toads. Pp. 163–164.

Scientific American. New York. Vol. 91.

Willey, Day Allen. The Work of a Western Cyclone. Pp. 81–82.

Science. New York. Vol. 20.

—— Temperature of the Lower Air. [Review of article of Woeikof.] P. 154.

Geographical Journal. London. Vol. 24.

Thomson, J. P. Queensland. [Climate.] Pp. 184–187.

Knowledge. London. New Series. Vol. 1.

Marriott, William. Temperature of the Air [of Great Britain]. Pp. 167–169.

Nature. London. Vol. 70.

Lockyer, William J. S. A Probable Cause of the Yearly Variation of Magnetic Storms and Auroræ. Pp. 249–250.

—— A New Self-recording Mercurial Barometer. P. 254.

—— On the Relation between the Spectra of Sunspots and Stars. [Review of article of Norman Lockyer.] P. 261.

—— Relation of Rainfall to Run-off. Pp. 299–300.

Philosophical Transactions of the Royal Society of London. London. Vol. 203.

Chree, C. An Enquiry into the Nature of the Relationship between Sun Spot Frequency and Terrestrial Magnetism. Pp. 151–187.

Proceedings of the Royal Society. London. Vol. 74.

Shaw, W. N. On the General Circulation of the Atmosphere in Middle and Higher Latitudes. Pp. 20–30.

Lockyer, Norman. On the Relation between the Spectra of Sun Spots and Stars. Pp. 53–54.

Quarterly Journal of the Royal Meteorological Society. London. Vol. 30.

Curtis, Richard H. Water-vapour. Pp. 193–209.

Cohen, J. B. One Cause of Autumn Mists. Pp. 211–218.

—— Meteorological Observations at Wadi Halfa. [Abstract of Meteorological Report for 1901, Survey Department, Public Works Ministry, Cairo.] P. 218.

Christie, W. H. M. Reports of Observatories for 1903. Royal Observatory, Greenwich. P. 248.

Holmes, R. L. Rainfall in Fiji. P. 252.

Crabtree, W. A. Observations at Masaba, Equatorial Africa. Pp. 255–256.

Hall, Maxwell. Meteorology of Jamaica. [Extract of article of Maxwell Hall.] P. 256.

—— Deep Earth Temperatures at Harestock and Southport, 1899 1903. Pp. 256–258.

Assmann, R. Temperature of the Upper Air over Berlin. [Extract from pamphlet of Assmann.] Pp. 258–261.

—— Temperature of the Air at 6 miles above the Earth. [Review of paper of Hann.] Pp. 261–264.

Sheward, R. Weather Notes in Samuel Pepys's Diary, 1659–1669. Pp. 264–266.

Science Abstracts. London. Vol. 7.

B[orns], H. Annual Variations of Insolation. [Abstract of article of Gorczynski.] Pp. 501–502.

B[orns], H. Values of Certain Meteorological Quantities for the Sun. [Abstract of Article of F. H. Bigelow.] Pp. 502.

Symons's Meteorological Magazine. London. Vol. 39.

Raulin, V. A Three Years' Period in Rainfall. Pp. 111–112.

B., D. C. Lake Movements and Thunderstorms. P. 112.

—— The Kew Observatory. Pp. 112–113.

Dines, W. H. A new Meteorograph for Kites. Pp. 109–110.

Horner, D. W. Ball Lightning. P. 111.

Ciel et Terre. Bruxelles. 25me année.

—— Le phénomène de desséchement dans l'ancien monde. Pp. 255–264.

Annales de Géographie. Paris. 13me année.

Passerat, C La température des pôles. Pp. 289–295.

Comptes Rendus de l'Académie des Sciences. Paris. Tome 139.

Chauveau, A. B. Sur la déperdition électrique dans l'air, au sommet de la tour Eiffel, pendant l'orage du 24 juillet. Pp. 277–278.

La Nature. Paris. 32me année.

Plumandon, J. R. La sécheresse de l'air. Pp. 90–92.

Mériel, Pierre de. Le cerf-volant et les sondages aériens à la mer. Pp. 101–103.

Le Temps qu'il Fait Mons. Août, 1904.

Bracke, A. Rides de nuages. Pp. 145–154.

Himmel und Erde. Berlin. 16 Jahrgang.

Nessen, Fr. Ueber unsere Schutzmittel gegen Blitzgefahr. Pp. 433–449.

Lendenfeld, R. von. Klima und Gletscher. Pp. 450–461.

Erendt, Th. Zur Gewitterkunde in Nord- und Mitteldeutschland. Pp. 462–472.

Das Wetter. Berlin. 21 Jahrgang.

Wegener, Kurt. Aus dem Aeronautischen Observatorium. Der Aufstieg von 25. März 1904 und eine "Drachenjagd." [Height attained 5080 m.] Pp. 85–88.

Hegyfoky, J. Das Maiwetter nach Zahlenangaben. Pp. 145–148.

Kienast, Hermann. Der Gang der Lufttemperatur in Königsberg i. Pr. Pp. 148–155.

Kreuschner, Curt Rudolf. Eis und Eisberge im Atlantischen Ozean. Pp. 156–159.

Geographische Zeitschrift. Leipzig. 10 Jahrgang.

Hettner, Alfred. Das Klima Europas. Pp. 371–390.

Physikalische Zeitschrift. Leipzig. 5 Jahrgang.

Guggenheimer, Siegfr. Ueber die Ionisation bei Ozonbildung. Pp. 397–399.

Lüdeling, G. Ueber eine Vorrichtung zur Registrierung der luftelektrischen Zerstreuung Pp. 447–451.

Illustrierte Aëronautische Mitteilungen. Strassburg. 8 Jahrgang.

Elias, H. Drachenaufstiege in den Tropen. Pp. 252–253.

Hemel en Dampkring. Amsterdam. 2 Jaargang.

Nell, Chr. A. C. De Beoefening der meteorologie in Nederland. Pp. 36–43.

Meteorologische Zeitschrift. Wien. Band 21.

Kremser, V. Bericht über die zehnte Allgemeine Versammlung der Deutschen Meteorologischen Gesellschaft zu Berlin am 7–9. April 1904. Pp. 297–316.

Quervain, A. de. Ueber die Synoptischen Wolkenbeobachtungen der internationalen Kommission für wissenschaftliche Luftschiffahrt. Pp. 316–323.

—— Hann: Ueber die Temperaturabnahme mit der Höhe bis zu 10 km. nach den Ergebnissen der internationalen Ballonaufstiege. Pp. 324–326.

—— Quervain, A. de: Ueber die Hebung der Atmosphärischen Isothermen in den Schweizer Alpen und ihre Beziehung zu den Höhengrenzen. Pp. 326–328.

Müller, Karl. Einige Beobachtungen am Sonnenschein-Autographen von Campbell-Stokes. P. 328.

Drapczynski, Viktor. Berechnung der mittleren Bewölkung aus der Zahl heller und trüber Tage für Habana. Pp. 328–329.

—— Dr. Eugen von Cholnoky: Der Witterungswechsel am Medarditage. Pp. 329–330.

Mazelle, Ed. Meerestemperatur bei Pelagosa. P. 330.

—— Hann über die Temperatur an der Ostküste von Grönland, Stykkisholm gegenüber. Pp. 330–334.

Hann, J. Resultate der meteorologischen Beobachtungen zu Marakesch (Marokko) 1900 und 1901. Pp. 334–335.

—— Meteorologisches aus Südafrika. P. 336.

Ficker, Heinrich v. Temperatursturz am 4. Mai in Innsbruck. Pp. 336–338.

Margules, M. Böe vom 4. Mai 1904 in Oesterreich. Pp. 338–340.

Schwarz, L. Schneefall mit Staub auf der Schneekoppe. Pp. 340–341.

Wolfer, A. E. Walter Maunder über die "grossen" magnetischen Stürme 1875 bis 1903 und ihre Verbindung mit Sonnenflecken nach den Aufzeichnungen an dem Königlichen Observatorium in Greenwich. Pp. 341–343.

THE MOVEMENTS OF THE HIGH CLOUDS IN THE WEST INDIES.

By JOHN T. QUINN, Esq., St. Kitts, W. I., dated May 24, 1904.

There was printed on the back of the Pilot Chart of the North Atlantic for August, 1902, a valuable paper on West Indian hurricanes, in the fourth column of which, in a passage describing the normal weather conditions within the Tropics, it is stated that, "The higher clouds (cirrus, cirro-cumulus) come in general from some point between north and east, the lower clouds (cumulus, cumulo-nimbus) from a point between east and south."

Having always believed that the "return trade wind," at least from Maury's time onward, had been universally accepted as a part of the ABC of tropical meteorology, I was very much surprised by the first part of the above statement, namely, that the higher clouds come in general from some point between north and east. The evidence for the generally accepted statement, that the high clouds in the West Indies move as a rule from some westerly point, seemed to be so conclusive that it was natural to assume that the statement in the article printed on the Pilot Chart must be a slip of some sort. But as it appears again in a reprint of the paper in question on the back of the Pilot Chart of the North Atlantic for September, 1903, it is perhaps not a slip after all; but in that case it would be interesting to know where the observations on which the statement is based were made, for it does not appear to be correct for the smaller islands of the West Indies or for the stretch of ocean that lies immediately in front of them.

From the following table it will be seen that out of 58 observations only 15 showed high clouds moving from a point in the northeast quadrant, and, as will appear later, some of these can be shown to be dependent on cyclonic movements, which have caused a deviation from the usual direction. It will also be seen that after entering as belonging to the northeast quadrant the 4 observations of clouds moving from the north there are still only 15 entries in that quadrant, while there are 30 entries in the northwest quadrant. If, therefore, we were to write in the passage quoted from the Pilot Chart the words "between north and *west*," instead of the words "between north and *east*," the statement would come much nearer to the truth, so far, at least, as the smaller islands of the West Indies are concerned. Still nearer the truth would it be to say that the high clouds come from some westerly point, for we see that out of the total of 58 entries 39 are in the western semicircle, while 19 only are in the eastern semicircle, and if the 4 entries of movements from the north were divided between the two semicircles, instead of being all put in the eastern semicircle, as they are in the table, then the relation would be 41 to 17.

As bearing on this question I have collected and arranged in the following table my observations of the movements of the high clouds, as observed from one or the other of the Danish Islands of St. Croix and St. Thomas (mostly from the former), during the months from July to November last year:

Date.	Clouds.	Direction.			
		From a point in the western semicircle.		From a point in the eastern semicircle.	
		NW. quadrant.	SW. quadrant.	SE. quadrant.	NE. quadrant.
1903.					
July 19	Cirrus	wnw.			
July 30	do	w.			
Aug. 1	do			se. or se. by e.	
Aug. 2	do			se.	
Aug. 4	do				n.
Aug. 17	do				n. by e.
Aug. 18	do				n. by e.
Aug. 23	do	w.			
Aug. 25	Cirro-stratus			ese.	
	Cirrus			e. or e. by s.	
Aug. 26	do		sw. or ssw.		
Aug. 30	Cirro-stratus	w.			
Aug. 31	Cirrus				e.
Sept. 1	do		sw.		
Sept. 5	Cirro-stratus		sw.		
Sept. 6	do		sw.		
Sept. 8	do		wsw.		
Sept. 10	Cirrus		sw.		
Sept. 11	Cirro-stratus		sw. or sw. by s		
Sept. 13	Cirrus		sw.		
Sept. 14	Cirro-stratus	nnw.			
Sept. 18	do	nw.			
Sept. 20	Cirrus				e.
Sept. 25	10 a. m. do	w.			
	3 p. m. do				e.
Oct. 1	a. m. do	nw.			
	p. m. do	nw. or nnw.			
Oct. 3	do	nw. or nnw.			
Oct. 4	do	w.			
Oct. 6	do				ene.
Oct. 7	do				ne.
Oct. 8	7 a. m. do				nne.
	2:30 p. m. do				n.
Oct. 9	Cirro-stratus	nw.			
Oct. 11	Cirrus	wnw.			
Oct. 13	do	w.			
Oct. 14	a. m. Cirro-stratus	wnw.			
	p. m. Cirrus	wnw.			
Oct. 15	do	wnw.			
Oct. 20	do	w.			
Oct. 21	Cirro-cumulus		s. or s. by w.		
Oct. 23	Cirro-stratus and cirrus.	w.			
Oct. 24	do	w.			
Oct. 25	Cirrus				ene. or ne.
Oct. 27	Cirro-stratus				n.
Oct. 28	do				nne.
Nov. 2	Cirrus				nne.
Nov. 3	do				n.
Nov. 4	do	nw. or wnw.			
Nov. 5	Cirro-stratus	wnw.			
Nov. 11	do	nw.			
Nov. 13	Cirrus	wnw.			
Nov. 14	Cirro-stratus	w.			
Nov. 15	do	w.			
Nov. 19	do	wnw.			
Nov. 20	do	wnw.			
Nov. 21	Cirrus and cirro-stratus.	w.			
Nov. 22	Cirrus, cirro-stratus, and cirro-cumulus.	w. by s.			
Total		30	9	4	15

It appears, then, that the westerly directions are the normal and the easterly the exceptions; and if the conditions over the surrounding ocean at the time were known, these exceptional cases might perhaps be all explained. For two of them, embracing 5 out of the 19 observations, it does, indeed, seem highly probable that the exceptional conditions causing the movements were revealed by the movements themselves, as shall now be noted.

It may perhaps be taken for granted that the theory of the spreading of the upper air from the vortex of a cyclone is now commonly accepted, and if the facts correspond with the

theory then the motions of the high clouds, after allowing for the effect of the earth's rotation and the forward motion of the storm, ought to point out approximately where the vortex is, and I think that in the two instances just referred to it can be shown that such was actually the case. The first of these two instances is in connection with the entries in the above table under date of the 25th of September. In the morning of that day, in St. Thomas, a few small cirrus clouds were seen to be moving with extreme slowness from the west or thereabout; at midday very careful observations could detect no motion in them; but further observations in the afternoon, several times repeated, showed that they were then moving very slowly from the east. This reversal of the motion of the high atmosphere suggested the appearance on the scene of a cyclone, say at a distance of some 500 or 600 miles eastward of St. Thomas, or more correctly, perhaps, northeast of St. Thomas. To a brother amateur I remarked that we must now watch our barometers, but the barometers gave no sign. Crossing the channel to St. Croix the same night, however, I found a considerable swell coming down the Anegada Channel from the northeast, and on arriving at Christiansted the next morning saw this swell surging on the "Long Reef" there. It had been surging in that way from the previous afternoon, and it continued through Saturday the 26th and Saturday night, but by Sunday morning was much reduced. This behavior of the sea confirmed the suspicion, raised by the reversal of the movement of the high air, that a cyclone, having its center far away to the northeast, had passed in front of the Anegada Channel. Such a cyclone would also pass along toward the northwest on the north side of the Virgin Islands; but no confirmation of these views was then obtainable. Twenty days later, however, the barque *Carioca* put into St. Thomas in distress, and reported having been dismasted in a hurricane blowing from northeast at 5 p. m. on Sunday, the 27th of September, the vessel being then about 200 miles south of Bermuda; also that the calm center of the hurricane had passed over her at 9 o'clock that evening. Later, it became known that a hurricane had passed over Bermuda the following day, the center, which was then moving toward the northeast, passing over the islands at about 1 p. m. There can hardly be a doubt that these two reports refer to the same storm, and it appears to be extremely probable that it was the same storm whose approach from eastward caused the reversal in the movement of the higher air over St. Thomas on the 25th, and which sent the heavy swell down the Anegada Channel to beat on our "Long Reef" at Christiansted.

The second of the two cases referred to is in connection with the observations noted in the foregoing table on the 6th, 7th, and 8th of October. It will be seen from the table that the high clouds on those days came, successively, from east-northeast, northeast, north-northeast, and north. According to the statement quoted from the Pilot Chart, these directions were usual, but according to the view taken in the present article they were *exceptional* and indicated the passage of a cyclonic disturbance north of these Danish Islands, and moving from an easterly to a westerly point. The earliest evidence of this disturbance was noticed on the afternoon of Tuesday, the 6th of October, when a light surf appeared on the "Long Reef" at Christiansted. This rapidly increased in force, and by 8 o'clock in the evening, which was calm, the roaring of the reef became very marked. All through the night the sound increased, and on the morning of Wednesday (the 7th) magnificent billows were seen breaking, one after the other, into successive lines of white foam running along the reef. The night had been very fine, with a well-advanced moon shining, and this gave the opportunity for noting that the sky was covered with cirro-stratus and cirrus clouds, moving very slowly from east-northeast. On Wednesday morning (about 8 o'clock) some well-defined cirrus streaks were seen moving from about northeast at a faster rate than that of the high clouds seen during the night. By Thursday morning (the 8th) the cirrus clouds were coming from north-northeast, and by 2:30 p. m. on the same day they were coming from north. On Thursday a moderate swell was running on the shore at Fredericksted (west end of St. Croix), showing that the storm center was then north or northwest of the Culebra Channel. On Friday morning the sea at Fredericksted was smooth, showing that the center had by that time moved far away. The obvious theoretical explanation of these facts is that a cyclone, moving from east to west, had passed to the north of the Virgin Islands; but no direct confirmation was obtainable, or, indeed, has since come to hand. We learned a few days later, however, of the heavy weather off the coast of the Southern States on Friday, the 9th, and Saturday, the 10th, and it seems reasonable to suppose that this weather was only a subsequent part of the effect of the movement revealed here by the heavy sea and the successive directions of the high clouds, sweeping around, as they did, from east-northeast to north, and, finally, through northwest to west.

The above two cases seem to show for 5 out of the 15 observations of high clouds coming from points in the northeast quadrant that they were exceptional; of the remaining 10 I am not able to offer any explanation, neither can I give any account of the meaning of the 4 observations made in August of high clouds moving from points within the southeast quadrant. The latter observations appeared to indicate danger for some of our islands, but no disturbance followed them, either among the islands or in the neighboring waters, so far as is known here. A wider knowledge of the facts might perhaps explain these observations, and of course there is always the chance of error in the observations themselves; but at all events the table shows double the number of movements from points in the western semicircle as compared with the eastern semicircle, and of the latter, 5 can be shown to be exceptional.

It appears, then, that there is good reason for regarding the movement from a point within the western semicircle as the usual movement of the high clouds in this part of the world, and any movement from a point in the eastern semicircle as exceptional, and therefore as calling for watchful observation. For navigators of these waters and for us of the West Indies, whose island homes lie like ships anchored in the tropical sea, it is of some consequence to be correctly informed on such points, and this fact may perhaps be admitted as a sufficient justification for the present article.

Although the preceding criticism by Mr. Quinn would appear to be well founded, in consideration of the general belief that the lower trade wind is from the east and the upper return trade from the west or southwest, yet there is much data on hand to support the original statement in the Pilot Chart, and the matter really requires elucidation by careful observation with the marine nephoscope. When at sea one must necessarily observe directly the apparent movement of the clouds relative to the motion of the observer. Navigators are expected to make some allowance for the latter, and to record the true movement as referred to either the true or the magnetic meridian. But this true movement is by them deduced from the apparent observed movement by a process of estimation that is really quite empirical and may often be entirely erroneous. For instance, the motion of a vessel going southward, or from the north, introduces an apparent northward component into the movement of the clouds. If the cloud is really moving from the west then its apparent motion is from the southwest. The difference between the true and apparent motion depends upon the velocity in miles per hour of the vessel and the cloud, respectively, and on the height of the cloud above the sea if we observe with the nephoscope, but on the distance of the cloud from the observer if we depend on the

unaided eye. There is therefore abundant room for a large variation in the navigator's estimate of the motion of the cloud.

The editor of the Pilot Chart says:

The statement to which Mr. Quinn calls attention was made with full knowledge that it was in opposition to the generally accepted theories of an eastward drift at high altitudes in the Tropics. It is, however, in accordance with the observations upon which the major portion of my hurricane article is based, namely the Greenwich mean noon observations returned by the voluntary meteorological observers afloat and cooperating with this office. These agree in showing that in the vicinity of the West Indies and during the hurricane season the motion of *what they call the upper clouds* is from a point between north and east, while the motion of *what they call the lower clouds* is from a point between south and east. It may be that the navigators did not properly distinguish between upper and lower clouds, or that they, on rapidly moving vessels, were unable to detect the slow eastward drift of the lofty cirrus. But inasmuch as my article was written for their benefit, and with the hope that it might prove of practical value to these observers in time of need, it seemed wise to adopt their system of classification and to present the phenomena as they appeared to, and were recorded by, the men for whom I was writing. It did not seem wise to attempt to explain to them that what they were in the habit of calling upper clouds were not upper clouds at all, or that the motion which they had recorded as taking place from the east was really in the opposite direction. It would probably have been safer to have based my statements upon the facts recorded by trained observers at regular meteorological stations. I may do this in future editions of the article, and at the same time request the mariner to see and record the facts as they really are rather than as they appear to be. Definite instructions to the voluntary meteorological observers at sea were first issued in 1901, prior to which time, and in some cases subsequently thereto, the cloud observations were signally lacking in accuracy.

My own analysis of the frequency of cloud motions during hurricane months, as observed at Belen College, Havana, gives the following figures:

Clouds.	Number of observations.	Percentage of frequency of movement from—			
		NE.	SE.	SW.	NW.
Upper.....	645	23	8	39	30
Lower.....	630	44	34	15	7

Mr. Page's analysis of the Havana observations shows that there is a very respectable percentage of upper cloud movements from the east. The extensive studies made by Professor Bigelow (see MONTHLY WEATHER REVIEW for April, 1904) show that great variations occur in the level that separates the upper westerly from the lower easterly movement. It may be quite possible that observers, both on land and sea, are unable to distinguish the altitude of a cloud by means of its appearance, and that so-called cirrus clouds are below the normal altitude as frequently as they are above it. It may be that cirrus clouds actually occur in the lower stratum as well as in the upper. The Editor observed continuously with his marine nephoscope on the island of Barbados and in its vicinity, during the cruise of the *Pensacola* in February, 1890, and found true cirrus clouds moving in a variety of directions between northwest and southwest and with a great variety of velocities. We should never forget that cirri and cirro-cumuli often form at the boundary between two layers of wind; the movement of the cloud is the resultant of the action of the two winds, and does not represent the actual motion of either nor the motion of any very important thick layer of air. The clouds simply move within the thin layer of mixture that separates the two more important masses.

Again, there can be no doubt that ascending masses of northeast trade wind and descending masses of southwest return trade frequently come into contact or collision, especially during the warmer part of the day, each obstructing the other's progress. As we approach the equator all trade-wind motion from the northeast gradually dies away. It can, therefore, happen that at points considerably removed from the equator the obstructed winds, rising and carrying their clouds with them, may produce the phenomenon of cirrus clouds from the northeast, while below these the descending winds may carry light cirrus clouds from the west. It seems likely that this phenomenon would occur most frequently on the northerly border of the track of a hurricane.

The more we consider the question here under discussion, the more convinced we must be of the great importance of improving and extending the methods and observations of the whole system of cloud observations on land and on sea.—*C. A.*

THE DISSEMINATION OF DAILY FORECASTS BY TELEPHONE.

By WM. G. BURNS, Section Director, Springfield, Ill., dated June 27, 1904.

The rapid development of telephone service in the Middle West, especially in the rural communities, has opened up a great field for the dissemination of the daily weather forecasts. This effective means was recognized over a year ago, and attention was invited to the fact in the Annual Report of the Illinois Section for the year ending June 30, 1903. While the development of the service in this section does not yet show altogether satisfactory results, arrangements are now under consideration whereby it is believed the information will be made available for 250,000, or more, telephone subscribers in small towns and rural districts.

The census of 1900 has credited Illinois with 264,000 farms, fully one-half of which, it is believed, are now supplied with telephones. The work of building new lines and connecting the different exchanges is rapidly progressing, and information has been received that one telephone supply house alone is furnishing new material in that direction at the rate of $500,000 a year.

A convention of State telephone managers was recently held in Springfield, Ill., and opportunity was afforded to address the body on the subject of cooperation. It was represented that all progressive exchanges maintained an information operator, and as the weather and its changes formed a vital subject of interest to the rural communities, the information operator would not be well equipped without this intelligence. It was further stated that in extending the telephone service the fact that the weather information would become available to its subscribers, would often be the determining factor in inducing an irresolute farmer to enroll. The facts presented were well received and active cooperation was promised. It has been planned to offer the service to telephone exchanges, and then notify the public through the press that the information is available.

Under the growing operation of connecting the exchanges into one vast homogeneous system, it will not be necessary to send telegrams to all, but, by careful selection of well located centers, a large territory may be covered by relaying the information from one exchange to another.

The following extract from the Copper Country News, Calumet, Mich., of June 21, 1904, shows that the plan which Mr. Burns advocates in Illinois has been approved in Ohio and Kentucky.

The extent to which the Weather Bureau is appreciated and utilized by the farmer is exemplified by the fact that the Cincinnati and Suburban Telephone Company has made an arrangement with the Weather Bureau in Cincinnati by which the farmers in surrounding counties in Ohio and Kentucky are enabled to get the daily morning forecast of the weather almost as soon as it is made.

The plan is to have the forecast telephoned immediately after its making to the central exchange in Cincinnati, which in turn will telephone it to the local exchanges in eight counties. These are to give out the information to the patrons in those places free of charge.

ATTEMPTS AT METHODICAL FORECASTING OF THE WEATHER.[1]

By LOUIS BESSON.

[Translated by Miss R. A. Edwards.]

At the present time scientific forecasting of the weather is

[1] Annuaire de la Société Météorologique de France, April, 1904, pp. 92–97.

based almost exclusively on the study of the daily synoptic charts, but it is not necessarily true that the process of local forecasting, based on the observation of meteorological instruments and the aspect of the sky, has lost all interest. Many persons possess a barometer and consult both it and the weather vane assiduously. In places that do not subscribe for the dispatches of the Central Meteorological Bureau, and that receive too late the papers that publish them, local observations constitute the one basis possible for the establishment of forecasts. Finally, in case a knowledge of the weather is gained from the analysis of synoptic charts, will it not be possible to perfect this knowledge, in making a forecast for the day, by means of local data recorded at the first morning observation?

It has appeared interesting to me to attempt to determine: (1) Precise rules for the utilization of the usual meteorological observations in forecasting weather at short range; (2) the degree of success that can be attained in the application of these rules.

I have restricted the problem to the forecasting of rain, and have considered, to the present time, only the winter season, that is, the months of December, January, and February.

The meteorological elements that I have considered are six in number; namely, barometric pressure, direction and velocity of the wind, temperature, and cloudiness, observed at 9 o'clock in the morning, and finally, the variation of pressure from 6 to 9 o'clock in the morning.

I propose to determine the degree of probability of rain (or snow), before midnight, according to the values of these six elements, taken the morning of the same day.

For this purpose I have taken the statistical records founded on twenty-one years of observations at Montsouris. Omitting the cases where it rained or snowed at 9 o'clock in the morning, 1546 days remained, representing $\frac{818}{1000}$ of the total number of days of observation. In considering the velocity of the wind I have been able, because of breaks in the anemometer records, to use the observations of only 945 days. I will limit myself here to a brief summary of the results obtained; they will be found explained more in detail in an early number of Annales de l'Observatoire de Montsouris.

Height of the barometer.—The probability of rain varies inversely as the pressure: from $\frac{86}{100}$ for a pressure of 742 millimeters it falls to $\frac{19}{100}$ for a pressure of 777 millimeters; nevertheless, from 747 millimeters to 752 millimeters it maintains practically the same value, $\frac{43}{100}$, and appears to increase a little for very decided heights of the barometer (more than 777 millimeters). It is $\frac{50}{100}$ for 763.5 millimeters. Consequently, if one possessed no other data than the pressure in making the forecast for the day, it would be safe to predict rain every time that the pressure, at 9 o'clock in the morning, was less than 763.5 millimeters, and, in the contrary case, no rain. This rule, applied to the 1546 days observed, was correct 64 times out of 100.

Barometric variation from 6 to 9 o'clock.—We may say, in general, that the probability of rain diminishes when we pass from an area of low pressure to an area of high pressure, but the variation of this probability is rather irregular: from $\frac{81}{100}$ for a fall of 15 millimeters it becomes $\frac{49}{100}$ for a rise of 0.5 millimeter, then remains almost stationary, between $\frac{37}{100}$ and $\frac{42}{100}$, when the pressure increases. For decided rises, it clearly increases and appears to rise above $\frac{50}{100}$. In forecasting rain when the variation is algebraically more than —0.3 millimeter, and fair weather in the contrary case, we will be correct 59 times out of 100.

Direction of the wind.—The probability of rain is minimum ($\frac{15}{100}$) when the wind blows from the east-northeast; it is maximum ($\frac{75}{100}$) when it blows from the west-southwest, that is, from a point diametrically opposite. From east-northeast to west-southwest by way of south the probability increases in a progressive and regular manner; from west-southwest to west it falls abruptly to $\frac{55}{100}$ and gradually decreases to $\frac{24}{100}$ at the north, and presents at the north-northeast a secondary maximum of $\frac{33}{100}$. In predicting rain only when the wind blows between south and west, one will be correct 67 times out of 100.

Velocity of the wind.—The chances of rain increase very regularly with the velocity of the wind. From about $\frac{25}{100}$ in perfect calm, the probability becomes $\frac{83}{100}$ for a velocity of from 8 to 9 meters per second. In case of greater velocity the probability seems to diminish. In all cases where the wind has been more than 9 meters we find only $\frac{75}{100}$ of rain. The value $\frac{59}{100}$ corresponds to a velocity of a little more than 4 meters. Forecasts based on this observation only are correct 62 times out of 100.

Temperature.—In general, the probability of rain increases with the temperature, but it presents for —3.5° C. a very evident minimum $\frac{22}{100}$, and for about —6.5° a secondary maximum of about $\frac{34}{100}$. For temperatures above —3.5° the probability increases at first rapidly, from 3° to 6° very slowly, and then rapidly again. It is $\frac{79}{100}$ for a temperature of 12°. In basing forecasts on temperature only, rain can be safely predicted at all times when the temperature exceeds 3°. This forecast will be correct 61 times out of 100.

Cloudiness.—At 9 o'clock in the morning, in winter, in Paris, the sky is completely covered 57 days out of 100; entirely clear 10 days out of 100. The intermediate degrees of cloudiness are much more rare. I combined them in two groups and obtained the following results: Percentage of probability of rain.—Cloudless sky, 12; cloudiness (0–4), 34; cloudiness (5–9), 52; sky covered, 52.

With these figures only as a basis, rain could be predicted whenever cloudiness was 5 or more. A forecast based on this probability would be correct 58 times out of 100.

Reviewing the percentage of probability of rain for each of the six elements, we see that the best criterion in forecasting is the direction of the wind; then come pressure, velocity of the wind, temperature, variation of pressure, and last, cloudiness.

If the figures of probability furnished by the various elements taken separately could be reduced to a common scale independently of each other, one would gain much in taking the average after having multiplied them by a factor proportional to their importance. In reality, these determinations are not independent; for instance, when the direction of the wind is southwest, the barometer is most often low and the temperature relatively high; these three elements tend, consequently, to give analagous indications, which do not correct one another. I have attempted to determine what proportion of success would be obtained by taking the mean of the statistics of probability furnished by the barometric height and the direction of the wind. This process, applied to 1546 cases observed, gives 70 per cent of correct forecasts. We have seen that 67 per cent of the forecasts based on direction of the wind alone would be correct. The gain is not considerable.

We do not increase the proportion of success in utilizing the six elements; it is decreased on the contrary in this case to 69 per cent. To explain this result, in appearance paradoxical, it is sufficient to remember the fact that the six determinations are not independent. The addition of four new elements to the first two (pressure and direction of wind) can tend to give too great a weight to one of these two elements and thus produce an unfavorable result. By giving the proper coefficient to each one of the six elements, one could probably raise the proportion of success a little, but after the attempts I have made I think it would not be possible to raise it sensibly above 70 per cent.

Probability of rain in combining two elements.—In the preceding, the probability sought has been determined in function of one element only, without regard to the values of the other elements. It is natural to think that in varying two elements

at a time and calculating the probability of rain for the various combinations possible for these two elements, one would attain to greater accuracy.

One can conceive, for example, that the coincidence of a low pressure and a wind from the northeast, which is usually accompanied by a high pressure, would be susceptible of furnishing a much better forecast than that which one could deduce from a low pressure and a wind from the northeast, taken separately.

The elements considered in this work can be combined two by two in 15 different manners. Among these 15 different combinations, I have studied 9 which appeared the most interesting: Pressure and variation of pressure, direction of the wind and pressure, direction of the wind and variation of pressure, direction and velocity of the wind, direction of the wind and temperature, and, finally, cloudiness combined with pressure, with direction of the wind, with the variation of pressure, and with temperature.

For each of the first five groups, the numerical results furnished by statistics have been reduced to graphic representations of three coordinates, representing the curves of equal probability of rain, traced for each 10 per cent. For each of the groups where cloudiness is concerned four curves of two coordinates have been drawn, relative to the four degrees of cloudiness previously specified.

Contrary to what one might hope, they do not present a great advantage over the curves representing one element. Certain of them give less satisfactory results than the one element. For instance, the curve representing pressure and direction of the wind combined furnished only 69 correct forecasts out of 100. Now, we have seen that in taking the mean of the probabilities, deduced separately, of pressure and of direction of the wind, we will be correct 70 times out of 100. The inferiority of the curve of two elements results from the fact that there are so few cases of areas of very high and very low pressure occurring with each direction of the wind that it is impossible to deduce any rule to govern these conditions. One is thus obliged to consider the probability of rain in such cases as equal to $\frac{50}{100}$. Now, with the probability $\frac{50}{100}$, in only one case out of two could rain be safely predicted.

As to the curves representing only one element, they may be extended to the most extreme variations of the element, and the cases that escape their application are very rare. In the field of general utility the two processes give equivalent results; in fact, if we take the proportion of correct to incorrect forecasts, we find that the proportion is the same for both.

In spite of the slight inferiority which the graphics of two elements offer, taken separately, they constitute, when we combine them, a better means of forecasting than the curves of only one element. After having attempted nearly all the combinations possible, I recognized the fact that in order to attain the maximum proportion of success it is best to use all the graphics of two elements enumerated above, excepting that combining the direction of the wind and the temperature, the addition of which is detrimental. We take simply the arithmetical mean of the eight figures of probability, and according to whether this mean is more than 50 we forecast or do not forecast rain. This method gives 73 per cent of correct forecasts.

It happens quite frequently that among the eight figures of probability there is one higher than 73 or lower than 27; in this case, it would seem that one should base the forecast on this number rather than on the mean of the eight numbers. I am convinced that in reality one gains nothing in proceeding thus, no doubt because 73 per cent is only a mean value, systematically of too little weight in this particular case.

I thought it interesting to apply this method to last winter, which is not included in the data upon which these curves are based.

In the course of the winter it rained or snowed 17 times at 9 o'clock. There remained seventy-four days, for which the forecast was correct 57 times and incorrect 16 times; besides, the probability, 50 per cent, was obtained once. The proportion is 78 per cent. The variation between this result and the average result, 73 per cent, deduced from a long series of observations, shows that one should expect to see the proportion of success attained vary from year to year, which is not surprising in considering a question into which chance enters to a certain extent.

The average success of 73 per cent could be considered as fairly satisfactory, but it should be observed that the question, as it is stated, admits of great difficulty, in spite of the short period covered by the forecast. To avoid all arbitrariness, we have considered as rain the least fall of water or of snow, even when reduced to fine drops of drizzling rain. Now, we frequently observe in winter, according to the temperature, drizzling rain or small flakes of snow, even when the general condition is that of dry weather. By treating in the same manner the question as to whether an appreciable amount of rain will fall—for example, 1 millimeter—we will certainly attain a higher proportion of success.

Having determined the slight advantage obtained by calculating the probability of rain in function of two elements instead of one, one may question if it would not be advantageous to calculate the probability in terms of three elements or more. This method is altogether impracticable at the present time. In fact, in order to establish statistics of probability based on three elements at the same time, it would be necessary to divide the data into a number of groups about ten times greater than for two elements and consequently ten times more observations would be required to obtain the same precision. Now, our twenty-one years scarcely suffice to calculate the probability in terms of two elements. More than two hundred years of observations would thus be required to calculate the probabilities in terms of three elements.

I will point out, in closing, some particularly interesting facts brought to light by graphics of the two elements.

For all winds, excepting those blowing between the north and the west, rain presents a maximum of probability for a pressure of about 750 millimeters; for winds from the east-northeast this maximum is very marked and corresponds to 755 millimeters.

The increase of the probability of rain with the velocity of the wind is verified for all directions, but it is very slight for winds from the east-northeast and is most marked for those between south and west.

The probability of rain increases with the temperature for all directions, but only reckoning from a minimum which occurs at about —5° for winds from the south, and about —1° for winds from the north. For winds from the north, the temperature presents a maximum at 3° from which it decreases.

When the sky is clear or slightly cloudy, the probability of rain is minimum for a barometric rise of 0.1 millimeter from 6 to 9 o'clock, and *increases notably with the rise.* Thus, for cloudiness comprised between 0 and 4, the probability is only 25 per cent for a barometric rise of 0.1 millimeter and becomes 50 per cent for a rise of 2.25 millimeters.

These remarks have not a great practical importance in weather forecasting, but they present a certain interest from a general meteorological point of view.

NOTE BY PROF. E. B. GARRIOTT, CHIEF OF FORECAST DIVISION, U. S. WEATHER BUREAU.

The local signs of approaching weather changes, rain for instance, necessarily vary in different countries, and, in many instances, in different parts of a State. The whole proposition, in fact, places local observations in the same relation to the reports of a meteorological service that the reports of a

meteorological service bear to world-wide reports. The reports of a meteorological service enlarge the area of vision and *permit the forecasting of local signs.* The future will undoubtedly provide for a similar treatment of the general weather conditions of a country by the employment of telegraphic reports from a world-wide area.

AIR RADIATION.

By C. C. HUTCHINS and J. C. PEARSON, Bowdoin College, dated July, 1904.

In 1892 one of the present writers carried out, at the request of Prof. Cleveland Abbe, some experiments for finding the radiation constant of atmospheric air. The radiation was measured from a hot, moving column of air of 1 centimeter depth in the line of sight, and as close as possible, consistent with proper screening, to the heat recording apparatus. Owing doubtless to defective surroundings, the results obtained from day to day showed considerable variation; in fact, more than could be produced artificially by changing the normal constituents of air in a closed room, such as dust and moisture, between wide limits. An average of the best results gave .00000114 small calories per second per square centimeter per degree for a thickness of 1 centimeter of the radiating layer.

In 1900 Professor Very published an extended monograph on the subject, in which very numerous experiments of his own and others are collected and discussed with the utmost skill and patience. Very's result, stated in the terms given above, at 100° excess temperature, was .00000036, or three times smaller than what we had obtained. This large difference led to a reexamination of our figures and methods, without finding anything that could account for it. An entire change of apparatus and method often leads to unexpected results, and may cause us to modify our views as to the probable error of our former consistent figures. In 1902 we constructed an entirely new apparatus, containing nothing that belonged to the old. A radio-micrometer, after Boys, was the heat receiving instrument. We avoided all suspicion of air contamination by taking air from out-of-doors. A box some 6 feet long, 2.5 feet wide, and 3 inches deep, containing a sheet iron bottom about halfway up, and covered with a single sheet of glass, was set at an angle of about 45° outside a south window. The upper end of the box was extended by a wooden chimney that projected through a slit in the window shutter. The box had trunnions at the sides, upon which it could be tilted by pulling a string. The radio-micrometer was mounted inside the shutter so that in the lowest position of the chimney the current of air that streamed up through came opposite the radio-micrometer opening. Sunlight falling upon the exposed glass cover heated the sheet iron bottom, and this in turn heated the air in contact with it, and a current of hot air was delivered through the chimney. The temperature of the hot air was obtained by a thermal junction of two thin copper and iron wires inserted in the stream, the circuit being completed through a calibrated galvanometer.

On clear, still days, excess temperatures of 50° to 60° of the hot air stream were obtained, and from the deflections produced, as compared with those produced by a lampblacked surface, at known temperature, we got values of the radiation constant that lay on both sides of the mean result of 1892. Great difficulty was experienced in getting a steady flow of hot air, and the behavior of the radio-micrometer was far from satisfactory. The experiments were discontinued when it was found that nothing new was to be learned by this method. We could at least conclude that the difference between pure air and that contained in an ordinary room with respect to radiating power was inappreciable.

The winter of 1902–3 was spent in improving the radio-micrometer, and an instrument of remarkable sensitiveness and accuracy was produced.[1]

[1] Am. Jour. Sci., Vol. XV, April, 1903.

This season we have taken up the problem anew with much improved apparatus and in very much improved surroundings. The investigation was carried out in the constant temperature room of the Searles Physical Laboratory, and the extreme range of temperature during the weeks of experiment has been less than 2°.

Finding our knowledge of the absorption of air for its own radiation in a very imperfect state, we turned our attention first to that problem.

DESCRIPTION OF APPARATUS.

The radio-micrometer was mounted upon a massive stone table, and screened from external sources of radiation. In line with the opening of the radio-micrometer was placed a truncated cone of sheet tin, 45 centimeters long, having an opening 1.5 centimeters in diameter, corresponding to the opening of the instrument, and enlarging to 5.5 centimeters at the other end. The cone is extended by a cold-drawn seamless brass tube, polished within, 280 centimeters long, and 5 centimeters internal diameter. Over the end of the brass tube is slipped a tin tube 8 centimeters in diameter, held in place by wooden rings and projecting 70 centimeters beyond the brass tube. These 70 centimeters are thickly set with diaphragms, having 5-centimeter openings, and the tube and diaphragms are carefully blackened. The legitimacy of using reflecting tubes for passing along a radiation from a distant source has often been called in question. All doubt should, however, be set at rest by recent experiments made upon the reflecting power of metals bathed in air, for long waves. Hagen and Rubens show[2] that all metals are practically perfect reflectors for radiations of great wave length, and it is certain that any difference between the reflecting power for air radiation, which is known to be of very great wave length, and the radiation from a lampblacked surface at slight temperature excess would be inoperative so far as our present purposes are concerned. Opposite the tin tube is placed the device for heating and delivering an air column. A box of wood, 100 centimeters by 35 centimeters by 14 centimeters, is mounted upon trunnions, so as to be tilted by pulling an attached string. In its vertical position, the column of hot air is delivered centrally past the opening of the long tube, but upon releasing the string the box tilts back out of the way. Beyond the air column stands a large blackened copper cube filled with water at the room temperature, and to this all temperatures are referred.

The box is filled with coils of iron wire, which are heated by a current taken from the lighting circuit, and the air flowing up through them is heated in turn. The temperature of the hot air is given by a thermometer having a very small bulb held in the stream at the height of the opening in the long tube.

EXPERIMENT TO DETERMINE THE ABSORPTION IN THE LONG TUBE FOR LAMPBLACK RADIATION.

As our values of air radiation were to be obtained in terms of radiation from a lampblacked surface, it became necessary to inquire whether the column of air in the long tube exerts any appreciable absorption upon the lampblack radiation. Langley, in his work on the temperature of the moon, has shown that a column of air 110 meters deep absorbs about 20 per cent of the rays from a blackened surface at 100° C. If the absorption follow Lambert's law, it would, in a column of air 245 centimeters deep, the depth used in the following experiment, be about 0.5 of 1 per cent, and may be neglected. The object of the following was to ascertain if the absorption changes with temperature excess.

A second blackened tank at a higher temperature than the standard tank was thrust in front of the tube and the deflection of the radio-micrometer noted. The following table gives the results:

[2] Drude's Annalen, Vol. II, 1903, p. 873.

TABLE 1.—*Depth of absorbing column, 245 centimeters.*

Excess temperature.	Mean deflection.
°	
4.06	62.6
6.62	103.5
9.55	163.0
12.79	224.0
12.18	51.63
20.91	94.17
30.60	145.3
40.90	200.3
50.00	252.5

The sensitiveness of the instrument was changed by withdrawing the condensing mirror at the point marked by the horizontal line through the table. To reduce all to a common scale, we need a reduction factor for change of sensitiveness. This will be the ratio of the deflection per degree excess for 12.79° to the deflection per degree excess for 12.18°, assuming that the radiation rate is the same for these two near temperatures. After applying this factor and dividing each deflection by its corresponding temperature, we obtain the following:

TABLE 2.

Excess temperature.	Deflection per degree excess.
°	
4.06	15.42
6.62	15.63
9.55	17.07
12.79	17.51
20.91	18.61
30.60	20.01
40.90	20.23
50.00	20.86

McFarlane gives a table[3] showing the radiation in small calories per second per square centimeter of a blackened surface. For 50° excess McFarlane's figure is .000326. Multiplying the numbers in the second column of Table 2 by such a factor as will reduce the last to .000326, we plot a curve with excess temperatures as values of x, and the observed radiation rates, derived as above, as values of y, and along with it a second curve from McFarlane's observations.

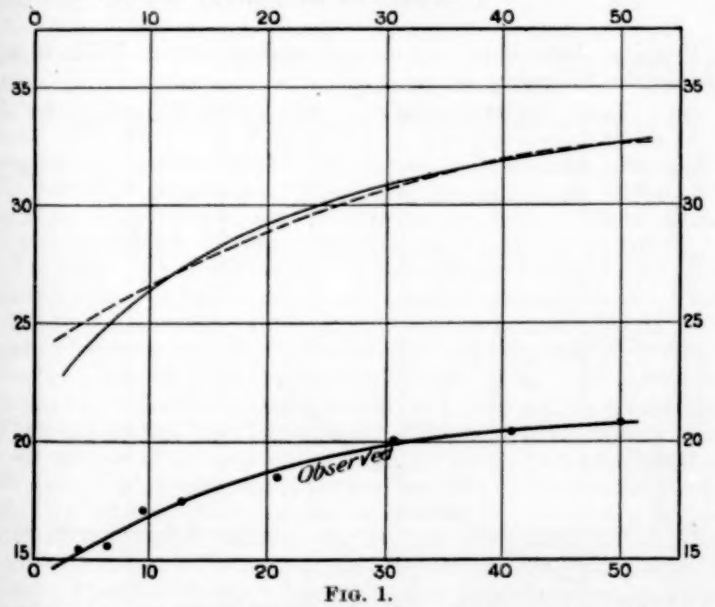


FIG. 1.

McFarlane's curve is dotted. It will be seen that there is nothing shown by the above results from which increased absorption at smaller excess temperatures can be argued. Considering the widely different methods by which these curves were derived, their agreement is quite striking. We feel sure, then, that we shall commit no appreciable error in effecting a comparison of air and lampblack radiation if we assume that the latter is unabsorbed by columns of air of the depth used in our experiments. In fact, difference in the manner of preparation of the lampblack surfaces is known to cause greater radiation differences than are shown here.

[3] Proc. Roy. Soc. 1872, p. 93.

ABSORPTION OF AIR FOR ITS OWN RADIATION.

The radiation of air can not be properly considered apart from the question of the rate at which its own radiation is absorbed. Very[4] obtains a change of deflection per foot of increase of radiating depth of 8.3, 10.0, 8.2, 10.4, —1.2, the depths being 1, 2, 3, 4, and 5 feet, respectively. Disregarding the rather discordant character of these figures, he rejects the negative change for 5 feet entirely on what seems somewhat uncertain grounds. We have sought to avoid the difficulty of absorption in the radiating column itself by measuring the depth of the absorbing layer from the center of a radiating column only 10 centimeters deep. Hence, if there be any outstanding error, it must be very small and, we believe, negligible.

A complete example of the method of proceeding is here given: The long tube being in place and carefully covered with asbestos steampipe covering, the current was turned on in the heating box, and at the end of half an hour the following deflections were obtained:

TABLE 3.

Deflections.	
55.0	
52.0	
54.5	
53.0	Date, June 29; air column, 491 centimeters; hot air temperature, 142°; room temperature, 20.5°; hot air excess, 121.5°.
55.5	
55.5	
52.0	
55.0	
56.0	
Mean.. 54.33	

The warm, blackened tank gave the following deflections:

TABLE 4.

Temperature, cold tank.	Temperature, hot tank.	Deflections.
20.56	24.05	106.0
.....	24.10	101.5
.....	24.18	109.5
.....	24.22	106.5
20.58	24.24	104.5
20.57	24.16	105.6

The mean deflection corresponding to 1° excess temperature of air is

$$\frac{54.33}{121.5} = 0.4472.$$

The excess temperature of the lampblacked surface is

$$24.16 - 20.57 + 0.59 = 4.18$$

where + 0.59 is the thermometer correction. Hence, the deflection per degree excess for the lampblacked surface is

$$\frac{105.6}{4.18} = 25.26.$$

Finally, the ratio of the hot air radiation to that from the blackened surface is

$$\frac{.4472}{25.26} = .01770.$$

On July 1 we obtained .0159; on July 2, .0177; on July 8, .01734; the average of six days being .01685.

The absorbing column was then made 245 centimeters, 127 centimeters, 61 centimeters, and 30 centimeters, and the same method followed for each distance, in each case the observations being distributed over several days. The results are tabulated below:

[4] Atmospheric Radiation, p. 45.

TABLE 5.

Absorbing column.	Mean ratio.
Centimeters.	
30	.0332
61	.0278
127	.0195
245	.0169
491	.0168

Plotting these observations with the numbers in the first column of Table 5 as abscissas and the numbers in the second column as ordinates, we obtain the following curve:

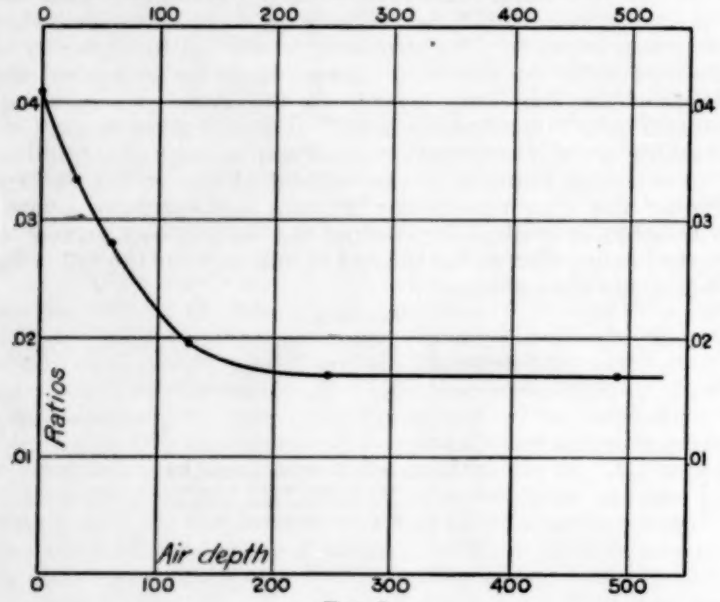


FIG. 2.

An inspection of fig. 2 reveals a very important feature of air radiation hitherto unknown; namely, that some 60 per cent of its own radiation is absorbed by a column as thin as 245 centimeters, the remaining 40 per cent being freely transmitted as though coming from a black body. We have plotted the ratios of air radiation to lampblack radiation per degree of excess temperature. The point where the curve cuts the Y-axis will correspond to the ratio at zero depth of absorbing column, and is important to know. This point may be calculated as follows:

Let

L = radiation from lampblack,

b = radiation of air for which absorption is neglected,

J' = characteristic radiation from hot air, that is, b neglected.

Then at zero depth, $b + J'$ is the total radiation from air. Lambert's law is $J = J' a^d$, and we have plotted the quantity $\frac{b+J'}{L}$ versus d. Taking $d_1 = 1$, and $d_2 = 2.033$, we have

$$\frac{b+J_1}{L} = 0.0332 = \frac{b+J'a}{L} \qquad (1)$$

$$\frac{b+J_2}{L} = 0.0278 = \frac{b+J'a^{2.033}}{L} \qquad (2)$$

$$\frac{b}{L} = 0.0169 \qquad (3)$$

We wish to find the value of $(b + J')/L$.

From (3) $b = 0.0169\ L$

whence, from (1) $J'a = 0.0163\ L$

and $a = 0.0162\ L/J'$

Substituting the values of a and b in (2), we get

$$0.0109\ L = \frac{(0.0163\ L)^{2.033}}{(J')^{1.033}}$$

whence $$J' = L\left[\frac{(0.0163)^{2.033}}{0.0109}\right]^{\frac{1}{1.033}}$$

This gives $$\frac{b+J'}{L} = 0.0409$$

This point fits in a perfectly satisfactory manner upon a smooth curve drawn through the observed points.

What the course of absorption may be beyond a depth of 500 centimeters, we have no means at present of judging. It may be suggested that the compound nature of air is responsible for its peculiar manner of absorption. Perhaps its contained water vapor is the substance radiating like a black body, and that apart from this, the strongly curved portion of our diagram shows the characteristic behavior of its prominent gaseous constituents. If this be true, it follows that the radiation of pure dry air is effective only at comparatively slight depths. The amount of moisture in the air during this course of experiments was considerable, the relative humidity not varying much from 78.2. It may be that water vapor so little removed from its point of saturation no longer behaves as a true gas, but as an aggregate of particles, in which case it would transmit all rays with considerable freedom, the particles producing a scattering effect merely. The accepted explanation of the color of the sky favors this view.

We have now to discuss the change of radiation of air with change of temperature. By introducing a variable resistance into the circuit of the heating box, the temperature of the heated air could be changed at will. A mean of five to ten consistent observations was taken for each temperature and the results tabulated as follows:

TABLE 6.

Excess temperature.	Mean deflection.
°	
22.5	18.55
28.2	24.9
43.2	40.9
72.1	77.9
87.0	105.7
125.5	185.9

Plotting deflections versus temperatures from Table 6, we obtain the following curve:

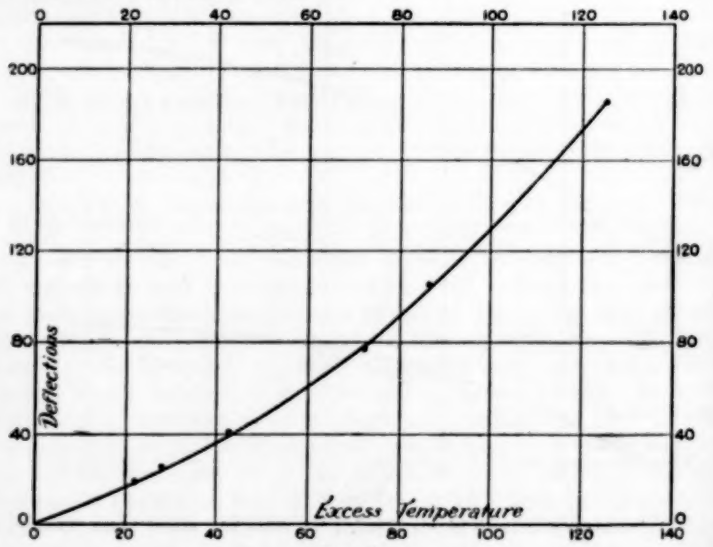


FIG. 3.

Calling D the deflection and t the temperature, the equation of this curve may be written,

$$D = At + Bt^2 + Ct^3,$$

from which, using three observations, we obtain

$$D = .7185\,t + .486\,t^2\,(10^{-2}) + .96\,t^3\,(10^{-5}),$$

the logarithmic coefficients being

$$\log A = 9.856448 - 10,$$
$$\log B = 7.687127 - 10,$$
$$\log C = 4.984735 - 10.$$

From the above the relative ratio of air radiation per degree at different temperatures may be found.

For $t = 1°$, we have $dD/dt = 0.728$.

For $t = 100°$, we have $dD/dt = 1.98$.

Hence the radiation per degree at 100° is $1.98/0.728 = 2.72$ times greater than at 1°.

There remains before computing the value of the radiation constant to find the temperature gradient of the hot air column in the line of sight; laterally, the central portion of the air column only was used, and no correction in that direction is required. A thermal junction of thin copper and iron wires was moved by steps through the heated air column, and the readings of a galvanometer, through which the junction was connected, noted. The edge of the opening in the air chimney being called 0, its center would be at 5. The following readings were obtained:

TABLE 7.

Distance.	Deflection.
5.0	155
4.0	155
3.0	155
2.0	155
1.0	149
0.5	124
0.2	105
0.0	90
—0.2	75
—0.5	50
—1.0	22

The air flowing up past the outside of the warmed box gave the deflections for negative values of distance; the integral of these was nearly sufficient to balance the loss for less temperature within the range of positive values of the distance. By plotting a curve and integrating the positive and negative values with reference to distance, and radiation rate as derived from fig. 3, we find the actual air column to be 0.967 as effective as a column 10 centimeters deep, and at a temperature measured at its center.

We are now prepared to calculate the radiation constant, h. Assume that this is wanted for an excess temperature of 100°, a depth of 1 centimeter, and zero absorbing column. We have:

Average of all excess air temperatures observed = 122°
Deflection for 122° from fig. 3 = 179
Deflection for 100° from fig. 3 = 130
Radiation per degree from lampblack at 4° excess; average = .000249 (McFarlane.)
Ratio of air to lampblack radiation for zero absorbing column, from fig. 2 = .041
Therefore, $h = (130/179)\,(.000249)\,(0.1)\,(.041)\,(0.967)$
$= 0.000000717$ water-gram-degrees per square centimeter per second per degree excess temperature.

For 1° this becomes 0.000000264, and may be found with great facility from the curves given, or from their equations, for any temperature or depth of absorbing column within the limits of our observations.

If our surmise be correct that the freely transmitted part of moist air radiation is from its contained water vapor, amounting to 40 per cent of the whole, then the above numbers would become for dry air, 0.00000043 and 0.00000016, respectively.

NOTES AND EXTRACTS.

OBSERVATIONS AT TASIUSAK.

The Danish Government has recently published the record of meteorological, magnetic, and auroral observations made at Tasiusak, in the district of Angmagsalik, during the years 1898–99. This district was first explored and charted in 1884–85 by G. Holm, who found there a hitherto unknown tribe of Esquimaux. Consequently, in 1894, the Danish Government established here a commercial station and a mission. The station at Tasiusak is on the southwest shore of a small fiord on the southern coast of the island of Angmagsalik. The terminal moraines of great glaciers approach within 20 miles on the northwest and 50 miles on the north. The Atlantic Ocean occupies a semicircle of the horizon from northeast to southwest. An arctic current flows between Tasiusak and Iceland, whose nearest point is 300 miles to the eastward. The latitude of the station is 65° 36′ 40″ north, longitude 37° 33′ 26″ west of Greenwich. The cistern of the mercurial barometer is 17.3 meters above mean sea level. The records of the Richard self-recording instruments are published for each hour of the day, in full from November 1, 1898 to May 17, 1899. But observations in general are at hand for seven years during the interval 1883–1900, or whenever scientific expeditions have remained at that place. Some of the more remarkable meteorological measurements at the station are elucidated in this report by means of charts of the barometric regions over the North Atlantic Ocean. During seven years it was very rare to find a month where the maximum temperature did not rise above that of melting ice. Even in January and February, although the minimum temperatures are 28°, 29°, or 30° below zero on the centigrade scale, yet the maxima are 3°, 4°, or 5° above; that is to say, from 37° to 41° Fahrenheit. The relative humidity of the air falls as low as 11 per cent in September and November, but in other months it ranges between 25 and 46. From November to February the wind blows from the northern portion. In April and May the most frequent winds are south and west, but calms are still more frequent, amounting to from 40 to 50 per cent in November and February. The greatest velocity of the wind, measured by the Robinson anemometer, occurred during the storm of November 25–26, 1898, and amounted to 47.4 meters per second, or 95 miles per hour. At that time a center of low pressure was moving eastward, just to the north of Tasiusak and over Iceland. In general the centers of low pressure passed to the west of Stykkisholm, on the west coast of Iceland, twenty-two times during the winter of 1898–99, but to the south of Stykkisholm eighteen times. Those that pass to the west undoubtedly pass near Tasiusak. Elaborate descriptions are given of the aurora borealis, and the statistics show that the station is located in the northern part of the zone of maximum frequency, or even entirely north of this zone, which traverses Greenland at the sixty-first degree of latitude, and then passes between Iceland and Greenland, probably over the island of Jan Mayen and continues on between the northern part of Norway and the island of Spitzbergen.—*C. A.*

CLIMATOLOGY OF BALTIMORE, MD.

For some years past Dr. O. L. Fassig has been compiling a work on the climatology of Baltimore and its vicinity. This report will form volume 2 of the reports of the Maryland State Weather Service, and is already in press. Progress toward the completion of the report has been delayed, owing to the fact that almost all the work must be done outside office hours, that is to say, at night time. Unfortunately, on two occasions, fire has destroyed many finished plates, but nearly all the numerical calculations have been completed, and a final draft of the outline of the report can be submitted. The complete

volume will comprise about 300 pages of text, 100 numerical tables, and 100 plates or figures in the text. If all goes well, the volume will be published in the autumn of 1904. It will be divided into the following chapters:

Introduction. General principles. Part 1.—Weather: The seasons; spring, summer, autumn, and winter for eighty-seven years. Storms affecting Baltimore. The weather of special days; February 22, March 4, etc. The weather of each decade. Weather forecasting; long-range forecasts; the moon and the weather; sun spots and the weather. Meteorological observations and organizations in Baltimore. Baltimore weather chronology. Part 2.—Climatology: Atmospheric pressure; mean hourly variations; annual march; extremes, etc. Temperature: diurnal march; hourly march; annual march; nonperiodic variations; water in the harbor; soil temperature. Humidity: hourly, monthly, and annual. Precipitation: diurnal, monthly, and annual; excessive; deficient; drought; snowfall. Hail. Fog. Cloudiness and sunshine. The winds: velocity; direction; diurnal, monthly, and annual. Electrical phenomena: thunderstorms; auroras.

Under the title, "The normal diurnal variation of the barometer at Baltimore," Dr. Fassig introduces a table of isopleths, or lines of equal quantity. These were, we believe, first introduced into meteorology in the French edition of Kaemtz's lectures, translated from the German by Charles Martins, Paris, 1843, in which edition a special chapter is added by Lalanne, a French engineer, on the graphic presentation of meteorological data. A chart of isopleths looks very much like a chart of isobars or a chart of contour lines in geography. Dr. Fassig describes his chart as follows: The mean hourly values of barometric pressure for Baltimore are presented in Table I for each month and for the year. The results for each season and for the entire year are also shown graphically in fig. 1 and fig. 2. In Table II, the same values are expressed in terms of departures from the average value for the entire day.

These tables and diagrams reveal for Baltimore the characteristic double barometric curve so well known to the meteorologists from the results of analyses of observations from all parts of the world, with perhaps minor peculiarities due to local conditions. The fluctuations are well marked in all months of the year, the amplitude varying from 0.060 inch in August to 0.071 inch in March. In fig. 2 the distribution of pressure is represented by a method not frequently employed, but one which shows clearly and in compact form the successive changes from hour to hour throughout the year. Upon a system of coordinates representing the hours of the day and the months of the year, isobars, or lines of equal pressure, are projected in such manner as to enable one to find the exact pressure at any hour of any month. For example, to find the average pressure at noon, in April, you run down the vertical line marked noon until the horizontal line marked April is intercepted, and find the isobar of 29.875. This method enables us also to see at a glance the chief characteristics of the seasonal distribution, further emphasized by differences in shading, the lighter shades indicating the lower pressures of the warm months, and the darker shades the higher pressures of the colder months.

In the next section Dr. Fassig has taken the trouble to compute the barometric variations on 60 clear days in January and February, and 30 clear days in July, as also variations on the same number of cloudy days in those months. The curves for the cloudy days coincide very closely with the general curve for all kinds of weather during the summer months, but diverge decidedly during the winter months. The curve for totally clear days also diverges from the normal in the winter during the night and early morning hours. The following section has an especial interest at the present time, on account of the attempts that are being made to explain the ultimate origin and nature of the regular barometric variations.

THE DIURNAL BAROMETRIC WAVE.

The diurnal variations of the barometer described in the preceding paragraphs are not simply of local occurrence, but are part of a general phenomenon extending over the greater portion of the earth's surface. The maximum and minimum phases pointed out occur in all localities at approximately the same hours of local time. As stated above, this pressure wave, as it may be called, has its greatest development in or near the equatorial belt, and diminishes in amplitude with distance north and south of the equator. It has some resemblance to a double atmospheric wave passing completely around the earth from east to west every twenty-four hours, having a velocity at the equator of about 1000 miles per hour. By plotting upon a map of the world the departures from the normal daily pressure for successive hours of the day at a large number of stations uniformly distributed over the Northern and Southern hemispheres, and joining such stations as have equal departures of pressure for the same hour, we have presented to us four systems of pressure distribution, consisting of two areas of low pressure and two areas of high pressure. These systems completely circle the globe and closely resemble in form the cyclonic and anticyclonic systems of the middle latitudes, but differ from them, among other things, in covering an area vastly greater, and in moving in the opposite direction. The diurnal fluctuations of the barometer are the local evidence of this vast double atmospheric wave passing around the globe daily. The westward propagation of these waves near the equator is represented in fig. 5 [not reproduced], the curve showing the time of occurrence of the different phases of the double wave, its amplitude, and the direction of propagation along the path of greatest development. The character of these waves is further indicated in fig. 6 [not reproduced], in which the successive areas of high and low pressure are exhibited at the time of their maximum development in passing from east to west across the North and South American continents.[1]

This double atmospheric wave, or tide, is so intimately associated with the apparent diurnal movements of the sun that the conclusion is almost irresistible that the pressure changes are due primarily to changes of temperature. This relationship has not yet been satisfactorily demonstrated to be that of direct cause and effect, but there seems to be a general consensus of opinion that the primary maximum and the primary minimum phases of pressure are direct effects of the sun's heat. The theory advanced many years ago to account for the chief maximum and minimum phases seems plausible. At the time of day, between 9 a. m. and 10 a. m., when the atmosphere is being warmed most rapidly and the tendency of the air to rise in consequence is greatest, the upper and colder layers impede this upward movement, resulting in a temporarily increased tension at the surface of the earth. When this tension is relieved the barometer begins to fall, reaching its lowest point about the middle of the afternoon when the upward movement of the warm air may be assumed to be least impeded.

As has already been stated above, the pressure wave attains its greatest amplitude in the equatorial belt where the diurnal temperature changes are greatest, and over the continental masses north and south of the equator where the diurnal range of temperature is most marked.

According to Dr. Hann,[2] in seeking an explanation of the diurnal variations of the barometer: "We had better deal with the action of the sun on the upper strata of the atmosphere and treat this as the principal cause. The actinometrical observations show us that these upper strata absorb a considerable amount of heat. The diurnal heating action of the sun on the upper strata would harmonize far better with the general uniformity of the daily barometric oscillation along the different parallels of latitude as well as with its general independence of weather. We need not quite exclude local influences, but these seem to be more of a secondary character." This view is also held by Lord Kelvin, who seems to have been the first to suggest this explanation.

C. A.

METEOROLOGY AT MONTPELLIER, FRANCE.

The meteorological observatory at Montpellier represents the meteorological commission of the Department of Hérault as well as the National School of Agriculture at Montpellier. The observatory and the commission began its work in 1872, or even earlier. The publication of the meteorological bulletin of the Department of Hérault began in 1873, and there has just been published a general index to the 31 volumes, 1873–1903, together with a few words as to the general activity of the institution.

In 1864 the Paris Observatory proposed to make a special study of the progress of thunderstorms through France. The Department of Hérault appointed a special commission to assist

[1] Fassig, O. L. The Daily Barometric Wave. Bull. No. 31, U. S. Weather Bureau. 8vo. Washington, D. C. 1902. Pp. 62–65, 12 pls.

[2] Hann, J. The Theory of the Daily Barometric Oscillation. Quart. Jour. Roy. Met. Soc. London, 1899. P. 40.

Le Verrier in this work. In 1872 the meteorologists of the departments of Hérault, Gard, Lozère, Aude, and Pyrénées-Orientales combined to appoint a meteorological committee for the western Mediterranean region; Prof. A. Crova was the general secretary of the committee. Each of these departments established stations with the necessary apparatus, and according to the original plan the observations were to be collected and published annually, together with the memoirs and discussions. Eventually all documents were to be deposited with the president and secretary of the committee. A public subscription was opened for the purpose of collecting funds for the support of the stations and the work. In August, 1873, the General Council of Hérault voted an appropriation for the printing of the meteorological bulletin of Hérault, and this has been continued annually. In 1879 the former commission was replaced by the meteorological commission of Hérault, established under the auspices of the Minister of Instruction for the Republic. This commission continued the work on thunderstorms started by its predecessor, and originated numerous other works under the direction of its president, Professor Crova. In 1881 Professor Crova was called to occupy the chair of physics in the National Agricultural School at Montpellier, and has utilized this favorable position to develop this organization of the meteorological observatory. In 1885 Professor Houdaille succeeded Professor Crova as professor of physics and director of the meteorological station. In 1888 the faculty of science was authorized to incorporate the laboratory, archives, and library of the meteorological commission with the collegiate department of physics. Therefore, the latter is now installed in a spacious locality adjoining a garden, where one can make experiments in the open air, uninfluenced by the vicinity of dwellings. The total amount of material accumulated in these volumes is very considerable, and the general index greatly facilitates the use of the data by students. Prof. M. Chassant temporarily fills the place of Professor Houdaille, who was attacked by a severe sickness in 1901. The general table of contents is divided into the following four sections:

1. The general alphabetical index by subjects, 18 pages. 2. Systematic index of subjects, 11 pages. 3. Author index, 15 pages. 4. List of plates and illustrations, 17 pages.

This is followed by a bibliography of those connected with the meteorological work of the department covering 58 names of persons or institutions, among whom Crova appears to be the most active.

The bulletins for the years 1902 and 1903 have been edited by Prof. Maurice Chassant, who conducts the course in meteorology and geology at the National School of Agriculture. This college, therefore, may be classed among those in which meteorology is associated with geology rather than with geography or with physics, as is done in many other cases.—*C. A.*

TORNADO IN MOBILE COUNTY, ALA.

[Reported by Albert Ashenberger, Observer, Mobile, Ala.]

On the afternoon of May 30, 1904, a tornado with a typical funnel-shaped cloud occurred in Mobile County, about 12 miles west of the Mobile Weather Bureau station.

The morning weather map of that date showed an area of low pressure central over eastern Arkansas and overlying the lower Mississippi Valley, with an extension of the depression merging with another low area over the lower St. Lawrence River. The accompanying rain area was characterized by numerous thunderstorms, and it was coextensive with the barometric depression.

The day's weather conditions at Mobile were marked by three thunderstorms. The sky was partly covered with clouds until 10 a. m. and was overcast with lower clouds afterwards. The winds were from the south and southwest and of light to fresh velocity. The temperature was normal. A high relative humidity obtained, the percentage recorded at both observations being among the highest during the month. The barograph shows no marked sudden changes; the pressure [reduced to sea level] fell almost steadily from 29.90 inches, at 9 a. m., to 29.76 inches, at 2:45 p. m., then the fall was less rapid and 29.75 inches was registered at 4:45 p. m., at which time a sudden fall of .02 inch occurred; this was followed by a stationary period of two hours and then a steady rise.

At Melton's farmhouse, five and one-half miles from the beginning of the storm track, the projecting top of the chimney was prostrated, and the roof of the kitchen, 50 feet south of the main building, was carried 60 feet in a northeasterly direction. This house did not indicate any sudden atmospheric expansion, as the sashes of a window facing the east were blown inward. About half a mile beyond Melton's house is the end of the path, marked by four prostrated trees. An occupant of the house stated that light rain fell at about 3:30 p. m., and thunder was heard and lightning observed in the southwest. At about 4 p. m. a violent commotion in the intensely dark clouds in the southwest was observed, and then the funnel-shaped cloud, like the smoke from a locomotive, was seen approaching, sometimes descending to the earth, and again receding. In a few moments the tornado passed with a heavy, roaring noise, like an approaching train. No lightning was observed in the cloud, but after the tornado had passed lightning was observed in the southwest, thunder was heard, and light rain fell. Rain amounting to .36 inch fell at Mobile from 4:07 p. m. to 6:05 p. m.

Mr. Leonard Lane observed the storm from the porch of his house, which is about one hundred yards to the right of the tornado's track, and about a mile from its beginning. He stated that the whirl was about two hundred yards in diameter, and the upward spiral movement from right to left was plainly discernible from the flying tree branches and other débris, and the rotating mass while passing his house had the appearance of an immense dry whirlwind without any low moisture-laden clouds.

The width of the path of the storm was not well defined, but near Mr. Lane's place, as stated by him, it was 200 yards; at Melton's place the prostrated fences indicated a width of about three hundred and fifty yards. The estimated value of the property destroyed is $200.

The time used in this report is ninetieth meridian.

HAILSTORM AT PUEBLO, COLO.

[Reported by J. P. Slaughter, Observer, Pueblo, Colo.]

On May 20, the worst hailstorm in the history of the city was experienced. Hail fell from 3:40 to 4:15 p. m., seventy-fifth meridian time. The ground was nearly covered with lumps of ice, ranging in size from ¼ to 2¼ inches, with an average diameter of about 1 inch. Some of the hail is reported to have been 9 to 10 inches in circumference, weighing 4 to 6 ounces. The hail is known to have covered a strip about 6 miles wide, and extended from a point about 8 miles west of this city to an unknown distance to the northeast. There was nothing unusual in the character of the storm except the size of the hailstones.

Damage to windows, fruit, and crops of all kinds will run far into the thousands.

EARLY AMERICAN WEATHER RECORDS.

In the report of the Maryland and Delaware section for May, 1904, Dr. Fassig has reprinted a letter dated February 27, 1755, written by Dr. Richard Brooke, of Prince Georges County, Md., communicating a record of maximum and minimum temperatures as observed with a Fahrenheit thermometer in September, 1753, to August, 1754. Dr. Brooke also says, "I have seen an account of the weather kept by a friend in Philadelphia which agrees with mine."

It is very much to be hoped that this latter record will also be discovered. The first Fahrenheit thermometer used in this country is supposed to have been that of Dr. Lining, of Charleston, S. C., March, 1738. His instruments were a thermometer by Fahrenheit, presumably graduated according to Fahrenheit's fourth or last method, and the same as now used; another thermometer by Thomas Heath, of London, divided into 90 equal parts, having No. 65 at the freezing point, No. 49 at temperate, and supposed to be the same as Hawksbee's. The hygroscope was a whip cord, which stretched five inches between its saturated and its driest point; these five inches were divided into a hundred equal parts analogous to our modern scale of relative humidity.

In 1742, Dr. John Winthrop, professor at Harvard College, began his record at Cambridge, Mass. He used Hawksbee's alcohol thermometer. "The scale is divided into 100 parts, beginning from a certain point above marked zero, and the hundredth degree falls just about at the bulb of the thermometer. The freezing point is numbered 65°. The divisions are upward to 8° above zero. The instrument shows the highest temperature, but not the lowest, for it goes into the bulb. How it was adjusted in London I know not, but it appears to me that the freezing point is marked considerably too high, for having plunged the bulb into a vessel of snow, I found that the spirit fell down to 76.5 and there rested."

In 1748, John Bartram began his record at Philadelphia, using a thermometer graduated to the Celsius scale. There seems to be a gap in his record between 1748 and 1758.

The record by Richard Brooke, in Maryland, extends only from 1753 to 1755. Much more information as to early observers may be found in the memoirs by Prof. A. J. Henry and others in Bulletin 11, part 2, but undoubtedly manuscripts and rare printed volumes, or almanacs and newspapers still exist and should be brought to light.—*C. A.*

WEATHER AND CROPS IN ARIZONA.

For the benefit of present or prospective Arizona farmers the Agricultural Experiment Station of that State has issued its Bulletin 48, Relation of Weather to Crops, by Alfred J. McClatchie. Observations under ordinary climatic conditions are scarcely applicable to Arizona, with its exceptionally low humidity and wide range of temperature. The report is based upon observations made during the past six years, and the effects of the weather upon each crop are considered in some detail. Almonds, olives, dates, and pomegranates are among the crops that may be successfully cultivated. According to the author:

> The total amount of agricultural products that Arizona will yield is limited principally by the quantity of water available for irrigation, but the nature of these products is determined principally by the climate of the region. The lowest temperature recorded at the experiment station during the last eight years in a shelter 5 feet above the ground was 17° F., and the highest 119°. The mean relative humidity is 35 per cent, and the annual rainfall is only from 5 to 8 inches. A larger number of crops endure the low temperatures that occur than endure well the high ones, a condition the opposite of that existing in the northern portion of the country. Instead of crops being grown between two winters, as is the case in the North, the most of them are grown between two summers, the number that grow through the summer here being about the same as live through the winter in the North.
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> In considering the effect of weather upon different crops, some difficulty is experienced in distinguishing with certainty between the results caused by the different phases of the weather and those caused by soil conditions. Differences in the physical and chemical conditions of the soil, especially differences in the amount of alkali present, cause more or less marked differences in the ability with which crops resist unfavorable weather conditions. * * *
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> Crops affect considerably the temperatures about and among them. Through the cooling effect of evaporation and radiation combined the temperature becomes lower among growing plants than it is over bare ground. The temperatures to which crops are subjected are, therefore, more trying during frosty nights and less trying during hot days than thermometers situated outside of their foliage would indicate. * * *
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> During weather too cool for the normal growth of a plant, direct sunshine promotes its activities and results in benefit. The almost continuous bright sunshine of our winters is, therefore, a distinct advantage to vegetation. During the warm portion of the year parts of many plants become overheated in direct sunshine and injury to tissue results. This is especially true of exposed stems, fruits, and vegetables. Since the leaves are continually being cooled, more or less, by the evaporation of moisture from their tissues, they do not become as highly heated as do stems and tree trunks, from which no evaporation is taking place. Hence, a plant or tree with heavy foliage that shades the other parts has a distinct advantage over one with slight foliage, provided it is supplied with sufficient water. * * *
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> Of the 80 crops discussed in a preceding part of the bulletin, 74 thrive best in an atmosphere having a somewhat higher relative humidity than prevails in southern Arizona. In some cases deciduous trees, though abundantly watered, are so affected by the dryness of the winter and spring atmosphere that they put out their leaves very tardily and incompletely, presenting the appearance of having been injured by extremely low temperatures. Very rarely is the atmosphere of the region too damp for the proper development of any crop. * * *
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> The direct effect of the local rainfall is not great. The higher humidity that accompanies it is a benefit, and the lower temperatures that accompany the summer showers are a relief to most crops. Local rains are heartily welcomed, chiefly because rain falls at the same time in the region furnishing the supply of water for irrigation.

The author made a series of temperature observations by decades for three years, with a sheltered thermometer 5 feet above the ground, and with three unsheltered thermometers at elevations of a few inches, 5 feet and 10 feet, respectively, and also, with the view of obtaining the temperatures to which the foliage of plants of various heights is actually subjected, with three unsheltered thermometers at elevations of a few inches, 5 feet and 10 feet, respectively. These last results have little quantitative value, as a bright-bulb thermometer exposed to the sun gives neither the temperature of the atmosphere on the one hand, nor, on the other, the temperature of foliage similarly placed, but probably approaches more closely to the former than to the latter.

The author also compares his results with the sheltered thermometer with those obtained from a thermometer at Phoenix, 2 miles distant, in a shelter 50 feet above the ground, and finds that the minimum temperatures recorded at Phoenix are from 3° to 6° higher. While the dry atmosphere of Arizona is favorable to temperature inversion, it is hardly safe to assume, with the author, that "this difference is evidently due entirely to the difference in elevation." He finds a decrease of about 2° in the mean maximum temperature at the higher elevation.

The undersigned is acquainted with but few researches that suffice to show, for moderate elevations, the effect upon the maximum temperature of height above ground. Some that have been published are of little value, on account of their short duration or the faulty exposure of the thermometers. Wild, observing at Pulkowa from September, 1872, to October, 1874,[1] with sheltered thermometers at heights of 1.9 meters, 15.9 meters, and 26.3 meters, obtained from the 1 p. m. observations the following mean departures from the readings of the lowest thermometer:

	Difference in ° C.	
	At 15.9 meters.	At 26.3 meters.
November–March....	+0.12	+0.11
April–September.....	−0.35	−0.37

Dines, in England,[2] September, 1876–September, 1878, found a mean maximum temperature of 58.7° F. in a shelter 4 feet from the ground, with a difference of —1.23° at an elevation of 50 feet. Glaisher, at the Royal Observatory at Greenwich,[3] with thermometers at 4 feet, 22 feet, and 50 feet, found in the mean temperature at 2 p. m. a decrease of 1.4° at 22

[1] Repertorium für Meteorologie, vol. 5, No. 2.
[2] Quarterly Journal of the Meteorological Society, vol. 8, p. 190.
[3] Proc. Met. Soc., vol. 5, p. 29.

feet and of 3.5° at 50 feet. But his observations cover only a few weeks in the hottest part of the year, from June 25 to August 6, and there is some uncertainty as to the protection of the thermometers.

G. J. Symons,[4] with observations from April to December, inclusive, at elevations of 4 feet and 170 feet above ground, finds a decrease of 1.9° F. in the mean maximum temperature at the upper station.

This matter is also discussed by Professor Abbe in the MONTHLY WEATHER REVIEW for 1897, vol. 25, p. 253, second column.

It is not at present practicable to answer the complex question as to what may be the exact nature and amount of the reduction of a temperature, wind velocity, or rainfall from elevated stations down to the exposure near the surface of the open ground. Undoubtedly on our elevated buildings the temperatures are slightly lower, the rain catch considerably smaller, and the wind velocity frequently larger than for stations at the surface of the ground, but comparison with other stations shows that the differences do not seem so large as has often been feared. So far as temperature is concerned, it is much more difficult to determine the true temperature of the air near the ground than at the top of a tall building, because at the ground the wind is much diminished and is liable to bring special streaks of hot and cold air. At the higher level, the special streaks of hot and cold air have all merged into one homogeneous mass, and the strength of the wind facilitates the ventilation of the thermometer shelter.

F. O. S.

THE WEATHER OF ICELAND AND EUROPE.

An interesting paper was read by Professor Hann before the Academy of Sciences at Vienna on January 7, entitled "The anomalies of the weather in Iceland, during the interval 1851–1900, and their relations to the simultaneous anomalies of the weather in northwestern Europe." It is well known that for many years the meteorologists of Europe have desired telegraphic information from Iceland, with the assurance that daily weather reports from that locality would certainly be very helpful in making daily weather predictions. By analogy it has been supposed that similar telegrams from Hawaii and from the Aleutian Islands would be exceedingly useful to the forecasters on our Pacific coast. It has even been argued that inasmuch as weather changes do not always mean from west to east, it might sometimes happen that reports from Iceland would be useful to the American forecaster. In fact, when a great area of low pressure is central in Iceland, there really is reason to believe that it does influence American weather by drawing the air from our extreme north southward over Canada and New England.

The object of Professor Hann's investigation is to arrive at a few general ideas as to the relation between the weather of Iceland and of northern Europe. He has studied the monthly and annual averages of temperature, pressure, and precipitation for the last half century, as recorded at Stykkisholm, and more especially the departures of the individual months from the general average, as compared with corresponding departures for the stations at Greenwich, Brussels, and Vienna, and with those for Ponta Delgada. The following sentences contain some of his more interesting results.

As regards barometric pressure, the departures of barometric pressure in northwestern and central Europe are in the opposite direction to the simultaneous departures at Stykkisholm in 70 per cent, of the cases. The same is true of temperature in only 56 per cent, and of precipitation in only 68 per cent, when we compare Iceland with Brussels.

The relation between the departures in pressure at Stykkisholm and the simultaneous departures in temperature over central and northwestern Europe is much more pronounced. When negative departures in pressure prevailed at Stykkisholm, then the probability of a simultaneous positive departure in temperature in Europe is 82 per cent. Inversely, when the pressure departure is positive at Stykkisholm, then the temperature departure is negative in 73 per cent of the cases for northern Europe.

An area of low pressure is almost stationary during the winter in the neighborhood of Iceland; if this low pressure falls decidedly, the winter temperature of Europe rises; if the central low pressure is higher than usual, the temperature of Europe is lower. The three largest temperature departures for each month and the year at Greenwich were compared with the similar departures in Iceland. Out of eighty-three cases, 84 per cent occurred simultaneously with a great departure in pressure in the opposite direction at Stykkisholm. In general, present investigation confirms the rule first enunciated by Buchan that a mild climate in northwestern and central Europe is associated with low pressure over Iceland.

Professor Hann then investigates the relation between the simultaneous anomalies of pressure at Ponta Delgada, Azores, and Stykkisholm; also the general relation between the high pressure of the tropical Atlantic and the low pressure of Iceland. On the average of forty-two cases, a rise of 4.5 millimeters at Ponta Delgada means a fall of 2.4 millimeters at Stykkisholm, and a fall of 5.1 millimeters at Ponta Delgada means a rise of 4.4 millimeters at Stykkisholm. In general, the probability of an opposite change at these two stations is 77 per cent.

Already in 1897, Hildebrandsson, in his researches on centers of action in the atmosphere, has given tables for ten years and charts bringing out in a general way the relation between pressures throughout the globe; but Hann's studies for fifty years give us a numerical result showing that to a certain extent the great areas of high and low pressure over the land vary inversely. The greatest positive departures of pressure at Stykkisholm correspond in 80 per cent of the cases to negative departures at Ponta Delgada, and the great negative departures at Stykkisholm correspond to positive departures at Ponta Delgada in 87 per cent of the cases. If the pressure over the Azores is higher than the average and at the same time the pressure over Iceland is lower, as happened in 70 or 80 per cent of the cases, then the gradient of pressure over the Atlantic Ocean is increased. The atmospheric machine works more intensively, and vice versa. The mean gradient difference in pressure between the Azores and Iceland is 14.7 millimeters in December, 18.3 in January, 14.3 in February, and 9.8 in March. The cases where the pressure over the Azores is unusually high and over Iceland unusually low are especially interesting; they are not to be considered as a result of the location of the subtropical belt of high pressure, but as a consequence of an increased intensity in the atmospheric circulation. If the northeast trade blows more powerfully than usual, it increases the maximum pressure on its right-hand side; but by this process the great whirl in the North Atlantic Ocean is intensified and the pressure of the atmosphere at its center near Iceland is diminished. Therefore, the above-proven contrasts in the pressure anomalies over the Azores and Iceland operate like cause and effect.

The last section of Hann's memoir deals with the relation between Stykkisholm (65° 4′) and the nearest station on the east coast of Greenland, namely, Angmagsalik (65° 37′), distant about 800 miles from each other. Stykkisholm is on the western coast of Iceland. Between it and Angmagsalik flows the cold polar stream on the west and the warm Irminger stream on the east, giving Greenland a cold climate and Iceland a relatively warm one. On the average of seven years of observations, 1895–1901, the mean difference of temperature between the two stations is greatest in February, 8.1° C., and on the annual average is 5.3° C. The gradient of temperature per degree of a great circle (111 kilometers, 59.9 geographic miles, 69.1 statute miles) is 1.1° C. in winter and 0.9° on the annual

[4] Proc. Roy. Soc., vol. 35, p. 349.

average, which is certainly one of the largest temperature gradients over the free ocean surface anywhere. The gradient between Stykkisholm and the coast of Norway is 1.3/35=0.04. The mean temperatures for Angmagsalik, reduced to the fundamental period 1851–1900, are: February, −10.8°; July, +5.4°; annual, −2.6°. For Stykkisholm we have, for the same months, −2.7°, +9.7°, +2.8°, respectively. Northwest foehn winds occur at Angmagsalik from the interior of Greenland, and two interesting cases are described by Professor Hann.

In a letter to the Editor, Professor Hann suggests that similar studies as to the relation between the American coast and the island of Bermuda are very desirable.—*C. A.*

A HOMEMADE GLOBE.

For some years past the officials of the Central Office have been familiar with the use of the plain india rubber balls 3, 4, or 5 inches in diameter as a basis for representing the earth, its meteorological features, the solution of spherical triangles, and many problems that daily present themselves for study. Especially has Professor Bigelow frequently advocated the advantages derived from using such small spheres on which lines can be drawn and erased. We find the following note, by A. Morley Davies, on the same subject in the Geographical Teacher, published for the Geographical Association at London, vol. 2, p. 173.

Listening at the Conference to Mr. Smith's paper on the use of globes, it has occurred to me that a simple plan I have followed might be of interest to other teachers. I obtained some plain india rubber balls, 3½ inches in diameter, of a terra-cotta color, for a few pence. I then thrust a long hat pin carefully through each, as the axis of my globe. Some I left at this stage for general use; others I marked with a few circles (such as equator, ecliptic, etc.) in paint; the advantage of the terra-cotta color is that white and black markings show equally well on it, so that different circles can be clearly distinguished. To illustrate either the plane of the ecliptic or the division of the earth into sunlit and dark halves, I use a piece of stiff cardboard with a 3½-inch circular hole cut out of it, into which the globe easily fits. The classes for which I use these balls are small ones; possibly in the case of large classes each pupil might make his own globe in this way. If anyone can suggest any substitute for hat pins, equally long and sharp but more rigid, it would be an improvement.

C. A.

DOES THE AURORA EVER ENVELOPE THE WHOLE EARTH?

No aurora is on record as having enveloped the whole earth simultaneously. The most extensive auroras, such as August 28–29, 1859, were visible in the course of that night over the greater part of Europe, West Africa, North America, and the Atlantic; or September 1–2, 1859, visible in the same way in North America and west to the Sandwich Islands, but not visible in Europe, where it was daylight, but magnetic disturbances were recorded there. These auroras of 1859 also occurred simultaneously in the southern and northern temperate zones, being observed in Australia and Chile. The most extensive aurora I know of was February 4, 1872, visible from Siberia and northern Greenland to India, Egypt, and Florida; also in Australia, Mauritius, and Natal. It seems plausible that if we had complete auroral records from all over the world, these great auroras might have been traceable farther east and west, north and south, but of course they could not have been in the daylight. If an aurora is seen on three successive nights at any one place, it is usually spoken of as three different auroras. It would only be allowable to call this one continuous aurora over the whole circle of latitude when we can prove that it was continuously visible during the night time at stations in different longitudes entirely around the globe. I believe this has never been done, but we came very near it in this last aurora of October 30–November 1, 1903, for which we have records from eastern Europe, the Atlantic, North America, and a large part of the North Pacific, while Asia is still to be heard from.

As regards "an aurora enveloping the whole earth," that would necessitate observing auroras in the tropical regions, so as to connect the north temperate with the south temperate auroras. Certainly this has never occurred, and it is not even plausible as an actual occurrence during the last two centuries, although plausible as a hypothesis applicable to some other condition of the atmosphere and the earth. Aurora encircling the earth between latitudes 40° and 70° north or south is plausible, but not yet proven to have occurred by actual observation.

Among the general works on auroras are: Das Polarlicht, Hermann Fritz, Leipzig, 1881. Aurora Borealis, Alfred Angot, International Scientific Series, vol. 81, London, 1896. Auroræ, Their Characters and Spectra, J. Rand Capron, London, 1879.

The general catalogues of auroras give the stations from which records have been received, and therefore the geographic extent. These are: Verzeichniss beobachteter Polarlichter, Fritz, Wien, 1873. On the periodicity of the Aurora Borealis, Joseph Lovering, Memoirs of the American Academy of Arts and Sciences, vol. 10, Cambridge, 1868.

In Nature, 1878, vol. 17, p. 373, there is a later note by Fritz discussing the question as to the simultaneity of auroras in America and Europe. Of 2878 days on which auroras were observed in America, there are 1065 on which they were also seen in Europe.

Especially during the years 1869–1872, out of 715 aurora days in America, there were 379 simultaneously in Europe. The author argues that the aurora is not a cosmical but a local phenomenon. The last extensive catalogue of auroras is that of Tromholt, published by the Academy of Sciences at Christiania. It contains several studies on auroral frequency and geographical extent by the editor, J. F. Schroeder, according to which the maximum frequency occurs in the northern regions of Norway in January, but in the southern regions in September and March, again confirming the idea that it is a local rather than a cosmical phenomenon.—*C. A.*

FAKE FORECASTS.

In ordinary mercantile business it is quite a common experience for the manufacturer of a good article that is rapidly growing in popular favor to find counterfeits or infringements on his patent springing up like mushrooms, and sometimes offering very serious and illegitimate rivalry. The Weather Bureau has gone through a very similar experience. In 1870 there were, we believe, no long-range forecasters known to the country, except the ordinary farmers' almanacs, and we doubt whether any but the most credulous placed any faith in them. I have often told of the confession of one of these almanac weather makers, who with a twinkle in his eye said that after the proper astronomical part of the almanac was completed, and when he was in the spirit for writing up the weather, he would sit down and make it up for a year ahead, or so long as he felt in the mood. He fully understood that some people can be gulled sometimes, but we all know that we can not fool *all* the people *all* the time. So far as we recall the names of those who have distinguished themselves for making popular weather predictions based on principles that are contrary to all our knowledge of meteorology, the list runs somewhat as follows: Vennor, 1875–1890; Hicks, 1890 to date; Dunne, 1892 to date; Foster, 1885 to date; Elmer, 1903 to date; Snavely, 1902–1904.

While these have been active in the United States, the rest of the world has also had its varied experiences. In England, Mr. Hugh Clements and his great expounder, Hon. William Digby, have vexed the printer with an imposing volume and the public with daily predictions in the local newspapers. These authors speak as confidently about the moon as Rev. Mr. Hicks does about Vulcan, Jupiter, and the other planets, real and imaginary. Italy and Austria have gone through a

sad experience with vortex-ring cannons for driving away hail. Russia has enjoyed the gratuitous services of Demtschinsky and his predictions based upon the moon.

In general, it would seem that weather prediction and long-range forecasts are so greatly desired that everyone is willing to give a man a fair show. The wonder is that the indefinite utterances of these oracles can be accepted as forecasts, or that their flat failure when they do become definite should not have consigned them to oblivion. Recall, for instance, the sad work of Falb, who in 1895 predicted terrible earthquakes and storms, possibly indicating the approaching end of the world, thereby frightening the whole of Spanish America, so that no work could be done for weeks and the whole community was thrown into a hopeless state of panic. Recall the prediction made about 1880 of an awful storm that would scourge the Gulf and South Atlantic States. Many of the intelligent inhabitants and nine-tenths of the less intelligent were frightened by the prediction, and allowed it to entirely alter their ordinary lives and business.

Who was it that in 1901 started a newspaper paragraph, purporting to come from some responsible person, predicting a hurricane for the coast of New Jersey on a certain date? So great was the anxiety that it was necessary for the Secretary of Agriculture to issue a counteracting telegram showing that the original was certainly a fake. A community even of the most intelligent, cool-headed people is likely to be carried off its feet by enthusiasm for some hero or by a mania for some financial scheme, or to be stampeded by fright. Emotions are contagious, and it is necessary for a community to protect itself against injurious popular movements, just as it would protect itself against injurious contagious diseases. Freedom of individual action is the ideal on which we have built up our republic; but when that freedom of action threatens the existence of the republic it must be restrained, moderately, if you will, and wisely, but still sufficiently to protect the public from danger. We would not for a moment countenance the publication of numerous nautical almanacs differing considerably in the prediction of the exact positions of the sun, moon, and stars, because we know that only one of these can be right, and that the others would certainly lead to errors in navigation that would endanger the lives of thousands of persons. The community does not allow either druggists or physicians to operate without first giving satisfactory evidence that they are competent to handle the drugs that they deal in. Every State has its laws relative to the licensing of steam engineers, since a steam engine in incompetent hands would be a menace to the lives of many.

Wherever the life and property of the citizens are at stake, the Government of the people, by the people, and for the people must necessarily look after their interests, and the time must soon come when a general law shall forbid the publication of weather predictions and storm warnings, especially those of a sensational character, by any others than properly licensed persons.

LIGHTNING STROKES IN THE OPEN FIELD.

It is commonly supposed that lightning strikes only elevated objects. In fact, on page 478 of the MONTHLY WEATHER REVIEW for October, 1902, Prof. John Trowbridge of Cambridge, Mass., shows how difficult, if not impossible, it is for lightning to strike down upon a smooth plane surface of water. Of course, the waves of the ocean and the irregularities on what is called a plane surface of land may occasionally be struck by lightning, and two cases of this kind have lately come to our notice.

In July, 1899, Mr. Morton Henry, on a farm near New Bethlehem, Pa., was in an open field, without trees near by, having only the horses, the plow, and a boy at hand. He and the boy sheltered themselves under the shoulders of the horses during a light shower from an insignificant looking cloud. The horses were killed instantly and the men rendered unconscious.

On July 10, 1903, Mr. Sylvanus Summers, and his son Clinton Summers, were loading hay on their farm seven miles northeast of Canton, Ohio. The sky was somewhat threatening and light thunder was heard in the distance. There was no local rain, the storm was apparently far away, the sun was shining through rifts in the clouds, the hay wagon was passing between two small piles of hay, when the lightning struck it, killing the horses and Mr. Clinton Summers and prostrating the others. The hay did not catch fire, and there were only slight burns on the horses, but Mr. Summers's clothing was ignited in several places. No thunder of any consequence was heard after that belonging to this particular stroke, and no rain fell at this locality, although it rained shortly afterwards about a mile farther north.

These are cases against which it is impracticable to provide, since no one cares to wear a wire cage, such as electricians recommend as a perfect protection for houses and powder magazines. We must accept them as corresponding to the legal term "an act of God," or an "inevitable necessity occurring by reason of the operations of nature unmixed with human agency or human neglect."

THE CLIMATE OF MANILA.

The following extract from an article by Mr. William E. Curtis, formerly Chief of the Bureau of Central American Republics, and now residing in Manila, is taken from the Washington Evening Star of June 4, 1904. It graphically expresses the convictions of the Editor, based on his own short experience in the Tropics, and is in harmony with the writings of the best authors on the subject. The meteorological elements of climatology, especially heat and moisture, constitute a source of discomfort, but only in rare cases one of danger or disease. The majority of individuals are so constituted that by a proper attention to diet they may successfully become acclimated. It does not seem proper to attribute to the climate of any place the diseases that are due to neglect, carelessness, living germs, and other nonmeteorological causes.

Mr. Curtis's article points out the numerous local sources of disease, foul water, bad sewerage, poor quarantine, ignorance and carelessness of newcomers; but all these are foreign to the climate proper, about which he makes the following remarks:

> The climate of Manila is no worse than that of Florida or New Orleans, Galveston, or any other of the Gulf ports of the United States. Its bad reputation is chiefly due to stories by those who did not know how to take care of themselves, and, being exposed to hardships, fatigue, and bad weather, being careless in their habits and ignorant of the dangers of the tropical sun and impure water, suffered from sickness, which they attributed to the climate instead of their own neglect.
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> It may be asserted truthfully that no tropical islands in the world enjoy a better climate than the Philippines, and if they were situated within a week or ten days' voyage of New York they would soon become a popular winter resort for pleasure seekers and a sanatorium for invalids. From the middle of November until the middle of March the atmosphere is delightful, and to those who like a semitropical climate like that of Florida it is unexcelled.
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> In the middle of the day the sun is hot, and those who are unaccustomed to it must wear pith helmets, carry umbrellas, and take the shady side of the street. Within doors it is always comfortable. A breeze springs up about 11 o'clock in the morning and blows gently all day and into the night. After 4 o'clock in the afternoon the air begins to grow cool, and from that hour until 9 the next morning through the winter months the thermometer will stand between 75 and 80 degrees day after day, with a breeze usually so cool that ladies need to wear a light wrap. During the night you will wake up and pull a blanket over you.
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> During the summer months, from the middle of March to the 1st of October, the atmosphere is humid and very depressing. Sometimes the air will be so heavy with moisture that it is difficult to breathe, and the pores of the body will flow with perspiration at the slightest exertion. This weather, however, is no more severe and the suffering no greater than that experienced in the towns along the Mississippi and Ohio rivers, in Florida, Texas, and the other Gulf States. Indeed, the temperature in Manila during the summer month after month will average lower than

in any of the States south of the Potomac and the Ohio. The thermometer never goes up to 100° and seldom above 90° even at noonday.

Manila is not subject to extremes like so many of our cities at home. The thermometer will remain about the same month after month, and may not vary 15 degrees in the entire year. This, however, is not favorable to the health or energy of people who are accustomed to sharp changes, and as a rule all who come to Manila complain of lassitude, of lack of energy and drowsiness, for the first nine months, or a year. This enervation continues until they are acclimated. Strangers who have been accustomed to a vigorous and bracing climate lose flesh as well as vitality, and may suffer from intermittent fever during the humid months of the summer. But this is equally true of Texas, Louisiana, and all of the Southern States and tropical countries, where it usually requires two or three years for a person to become acclimated so as to endure the summer heat without physical depression. Some people never become able to endure the humidity of Manila without suffering, and the damp summer climate is particularly severe upon young children, sapping their vitality and thus rendering them more liable to disease. But the winter months in the Philippines are quite favorable to children.

CLIMATE OF THE ISLANDS.

The climate of the Philippines naturally varies according to the latitude and altitude of places. There is a choice of about 1200 miles of the former and 7000 or 8000 feet of the latter. Manila, according to general repute, has the worst climate in the archipelago, but it is no worse than that of other cities at tide water. People who live in them cannot avoid the debilitating influence of the heat and the humidity of the rainy season of the summer, but the highlands of the interior, even within a few miles of the coast, enjoy a cool, invigorating atmosphere, healthful and bracing the entire year, although everywhere one goes it is necessary to protect the head from the direct rays of the sun and to avoid drafts. Inexperienced people expose themselves to fevers by coming in from the blazing sunlight, reeking with perspiration, and sitting down in a breeze to cool off. This is the most frequent cause of illness in all the Philippine Islands and one that is most easily avoided. Americans are accused of recklessness in exposing themselves to the sun and refusing to wear the heavy helmets and carry the umbrellas that other foreigners habitually use.

FUTURE SUMMER CAPITAL.

Within a short distance of Manila, almost within sight of the city, is the mountain town of Baguio, in the adjoining province of Benguet, where it is proposed to build a summer capital and remove all the offices of the government for the four rainy months of the years. Maj. L. W. McKennon, formerly of General Schofield's staff, has been detailed as supervising engineer, and is now engaged in building a town, at the expense of the Government, 4770 feet above the sea level in the midst of a vast forest of pine, where the climate is as healthful as that of the Adirondacks or the Black Hills.

Major McKennon is erecting official residences and office buildings, and several of the officials and employees are erecting bungalows for themselves, so that before the end of the season there will be quite a town. The military authorities intend to build barracks for soldiers, and the Roman Catholic authorities will build rest houses for the recuperation of priests and teachers. The Methodists and Episcopalians have already purchased land for the same purpose, and several members of the mercantile colony of Manila will take advantage of the public sale of lots to secure sites for themselves.

ADVANTAGE OF A SUMMER CAPITAL.

I wrote you from India about the summer capital of that empire; how a century's experience had demonstrated that it was not only economical but otherwise advantageous to remove the entire government from the unhealthy climate of Calcutta during the rainy months of the summer to the town of Simla, in the foothills of the Himalayas, where there is a duplication of the official quarters and residences of the government employees. This has been the work of many years, and it will take many years to fully carry out the same purpose in the Philippines. And no matter what the cost may be the expenditure will be wise and the investment will pay in more respects than one. It will enable the business of the Government to be continued through the entire year without interruption; it will promote health and happiness; it will enable valuable men who can not endure the heat and humidity in the summer to accept official responsibilities in the Philippines; it will take away the necessity of long vacations spent in America; it will reduce the number who are sent home as invalids, as there will be no necessity for long sick leaves for Government employees, and that item alone will save an amount equivalent to a fair interest on the investment; and, what is more important, it will restore and preserve the health of faithful public servants who are devoting their lives to the welfare of this people.

C. A.

AN ITALIAN HAILSTORM IN 1545.

Mr. E. L. Cooley, of Chicago, has kindly communicated to the Chief of Bureau the following account of a hailstorm that occurred in July, 1545, about a day's journey south of Lyons. The description as given by the artist, Benvenuto Cellini, who was then journeying from Paris to Florence, will be found in vol. 2, p. 88, of his autobiography, published in London, 1903:

When we were a day's journey from Lyons, about 22 o'clock,[1] the thunder began to rattle in the sky, though the air was clear as possible. I was a bowshot in front of my companions. After the thunder, so great and terrible a noise was heard in the heavens that, for me, I thought the Day of Judgment was at hand. I stopped for a time, and hail began to fall, without a drop of rain, larger than chalk balls from an airgun. When they fell on me they hurt me greatly. Gradually they became bigger, until they were like balls from a crossbow. My horse was terrified, so I turned him about and galloped as furiously as I could till I found my companions, who had withdrawn into a pine wood in their fright. The hailstones were now as big as lemons. I began to sing a miserere, and while I was thus speaking devoutly to God, there fell one of such a size that it snapped a huge branch of the pine tree under which I had thought myself safe. Another fell on my horse's head and almost knocked it down. Then one hit me, but not directly, else I should have been a dead man. At the same time poor old Lionardo Tedaldi, who was kneeling like me, was struck so hard that he fell on all fours. Then I saw that the branch was no longer a shelter, and that one must do something besides singing misereres. So I began to wrap my garments around my head, and I told Lionardo, who was crying "Jesus, Jesus!" at the top of his voice, that Jesus would help him if he helped himself. It was more trouble to save him than to save myself. The fury of the storm lasted for a considerable time; but it stopped at last, and, all bruised as we were, we got upon our horses as best we could. While we were riding toward a lodging we showed each other our scars and our bruises; but when we had gone a mile we found the marks of much greater damage than we had suffered—indeed, our eyes were met with a scene of ruin which it is impossible to describe. All the trees were stripped and broken, the beasts that had been out in the storm were killed, and many shepherds too, and we saw hailstones so big that you could not have spanned one with your two hands. We thought we had come off well, and owned then that calling on God and repeating the misereres had served us better than if we had only tried to save ourselves by our own strength. So, with thanks to God, we set off for Lyons, reaching it the next day, and there we put up for a time.

The following extract from the reply of the Chief of the Weather Bureau to Mr. Cooley contains good suggestions for all who have opportunity to observe such hail:

Hail that is on an average two inches in diameter is very often reported from heavy storms, and occasionally masses of ice, perhaps agglomerations of hail, are said to reach a size quite as large as those that Cellini could scarcely span with two hands. If it ever should be your luck to be present when such enormous hail occurs, I will beg you to kindly see that a number of measurements are made of the size and weight of a large number of specimens, as also of the general average quantity of ice per square foot lying on the ground, so that we may have more exact data for calculations as to the origin and formation of hail. The internal structure of the hailstone is exceedingly curious, a series of concentric shells of clear ice and snowy ice. By splitting a hailstone in half and quickly making a drawing showing these concentric layers, with such indications of crystalline structure as you may be able to detect, you will add to our knowledge of interesting facts. The most remarkable peculiarity is said to be that, if a hailstone is held under water until it melts, the observer will, at the last moment, notice that the small bubble of air at the center bursts through the last layer of ice and expands to several times its original diameter as it starts to rise to the surface of the water. This indicates that when in the hailstone it was compressed under great pressure. If you can determine even approximately the diameter of the bubble before and after its liberation from the ice, you will give us the means of determining what that pressure was.

If you can split a hailstone into thin layers across the center, and give us photographs of a few of these, we should know more about the internal structure of the hail.

Foreign objects, such as stones, leaves, twigs, nuts, and insects, are often encased within hailstones. Such occurrences should be noted, as they demonstrate very clearly the existence of strong upward currents of air that are supposed to be a necessary concomitant of the formation of hail.

C. A.

[1] In the old Italian system, which still continues in some sections of Italy, the day ends at sunset, and the hours of the new day are counted continuously up to 24 at the following sunset. On this system, therefore, the beginning of each day varied not only with the latitudes, but also from season to season throughout the year. Therefore, in July, near Lyons (latitude 46° N.), 22 hours was probably about 5:30 p. m. local mean time.—ED.

SECULAR CHANGES IN CLIMATE.

We are indebted to Mr James P. Hall of the editorial office of the New York Daily Tribune, for the following summary of the last two chapters of Ward's translation of Hann's Climatology. It presents the general impression that one obtains from reading Hann's summary of the recent condition of our knowledge of observations and theories bearing upon the periodic or the secular changes that the climate of any portion of the globe has experienced during recent centuries or past geological ages.

Mr. Hall says:

Dr. Hann is one of the world's leading authorities on atmospheric physics. He has summed up the work of other investigators more completely than anyone else. The second edition of his handbook is much more recent than the writings of Blodgett, Maury, Buchan, and Loomis. The value of the translation is distinctly enhanced by the notes of Professor Ward, himself a meteorologist of repute.

The suspicion that the climate of any country has permanently changed in so short an interval as one or two centuries is discouraged by Dr. Hann. He recognizes the existence of irregularities which sometimes show a disposition to fall into cycles, says that hasty conclusions have been drawn therefrom, but does not think the supposed chances well established as yet. Of the slow oscillations that have received the most attention, that running parallel with the 11-year sun-spot period is the first one mentioned. The Austrian cites some of the affirmations of Kœppen, Meldrum, and Lockyer regarding it, but concludes that most of the evidence which had come to him "is still too uncertain to show any actual relation between cause and effect." As most of Bigelow's work has been done since that opinion was expressed, the comment can hardly apply thereto. Brückner's observations, tending to show that there is a cycle in temperature and rainfall thirty-five years long, are viewed with favor. Dr. Hann thinks that he has "demonstrated the existence of the period with a high degree of probability."

That other climatic changes, far more extreme in degree and stretching through vastly longer periods, have really occurred on the globe is beyond question. Geology shows that in the Tertiary age vegetation such as is now found only in temperate latitudes flourished in the northern part of Alaska and Greenland and in Spitzbergen. Later a vast ice sheet from the Arctic reached away down in North America to the Ohio River and the south shore of Long Island. A large part of northern Europe was similarly covered. The snow line of the Alps was more than 4000 feet lower than now. Concerning the causes of the Glacial period, which is now believed to have been a series of intermittent visitations, there has been a vast amount of ingenious speculation. Practically all of the more striking hypotheses advanced to account for these changes are astronomical. Dr. Hann reviews several of the most important. He refrains from discussing the theory of Dubois, based on the probable fluctuations in the sun's thermal output, but mentions the inferences which have been drawn from the changes in the inclination of the earth's axis to the ecliptic, in the eccentricity of its orbit and the unequal length of the season.

The earth, it will be remembered, is some 3,000,000 miles nearer to the sun at one point in its orbit than on the opposite side. Just now it is there—at perihelion—during the winter of the Northern Hemisphere. The cold of that season results from the fact that the North Pole is tilted away from the sun. If, however, our winter came when the earth was at the greatest distance—at aphelion—the season would be much more severe, as well as longer. Owing to well known causes the position of the globe is slowly shifting, so that it works its way half way around the circle in ten thousand five hundred years, and gets back to the starting point in twenty-one thousand. Adhémar thought that a succession of aphelion winters would create such an accumulation of ice near the pole as to shift the earth's center of gravity, and lead to such a flow of water thither as to flood the continents partially. Schmick assumed that the latter effect might also result from an enhanced influence of the sun on the tides. Dr. Hann shows how little valid reason there is for accepting either of these notions.

Croll started with the same premises, but improved on the suggestions of his predecessors. The most novel feature of his theory was that during the long series of years in which the earth had aphelion winters the force of the northern trade winds would be increased, a larger amount of tropical water would be driven south of the equator than now, and the genial influence of the Gulf Stream on northern Europe would be diminished. Dr. Hann feels that climatology owes much to Croll for calling attention to factors previously overlooked, but he presents cogent reasons for not accepting that expert's theory. It is pointed out that it is the coast contour, rather than the trade winds, which chiefly controls the direction of the flow of equatorial water, while it is also held that severe cold in either hemisphere would not materially alter the strength of the trades. Though Sir Robert Ball professed to have treated the problem in a new way, Dr. Hann insists that his main argument had been advanced by others and is fallacious.

De Marchi cautiously suggests that if there were a trifling decrease in the case with which the air transmitted heat, inward from the sun and outward from the earth, an ice age in middle latitudes might ensue. He puts the requisite diminution at 10 per cent, or a decrease from a coefficient of 0.60 to one of 0. 54, but does not like to say what could thus diminish the thermal transparency of the atmosphere. Perhaps an increase or decrease in the amount of water vapor or carbon dioxide there might do it. Svante Arrhenius thinks that prior to the glacial period arctic warmth may have been due to an excess of carbon dioxide, liberated by volcanoes, while a reduction of the proportion would explain the temperatures of the ice age.

Dr. Hann holds that the simplest and most obvious explanation of secular changes in climate thousands, perhaps millions, of years ago would be the assumption that the position of the earth's axis had shifted. George H. Darwin, the astronomer and mathematician of Cambridge, says that the pole could not move more than 3° if the globe were rigid, but might get 10° or 15° away if it were plastic. Schiaparelli, at Milan, has reached a similar conclusion. Davis (of Harvard) has considered at length the probable effect of moving the North Pole down to latitude 70° in west longitude 20°. This change would glaciate northwestern Europe and northwestern (?) America. The question hinges, it will be seen, on the past plasticity of the globe. Despite the earth's present steel-like rigidity, Dr. Hann says that the past permanence of the pole has not been established. It is conceivable that geology may yet throw more light on this point.

A TERTIARY RAINBOW.

Mr. J. Neff Huyette, of Chicago, Ill., under date of May 16, 1903, writes as follows:

The forenoon of May 2, at Chicago, was clear, or very nearly so, up to about 11:30, at which hour the occasional light wisps of cirrus were replaced by very large masses of cirro-stratus, through some of which the sun shone but faintly. As the first of these passed over the sun a barely perceptible ring was seen, the lower portion of which, however, was quite brilliant. Just about halfway between the lowest part of this ring and the horizon I saw a bright streak, which I at first took to be a patch of cloud evolving into cirro-cumulus; but on looking a few moments later it was found to have assumed the most beautiful rainbow tints. I then looked overhead to see if there was a circle in that part of the heavens to correspond, but found none. This very beautiful sight lasted but a short time, beginning at 11:55 a. m. and ending at 12:03 p. m. The manner in which it disappeared was in keeping with the rest of this interesting sight: First some dark clouds passed gracefully over, after which the vision shone forth with increased beauty; then it appeared to move along to the east for a short distance, where it vanished. This latter occurrence seems to indicate that the cloud which caused the phenomenon covered but a comparatively small portion of the space within which this phenomenon could take place.

I may say, in closing, that I saw no curvature in the halo, and, with the exception of the fine coloring and brilliancy, there was nothing striking, as the halo itself was very ragged and broken.

I send you this account because it is the first time I have ever seen anything of this kind, and I have always kept a sharp lookout for this phenomenon, particularly since reading Mr. Warren's letter in the MONTHLY WEATHER REVIEW for June, 1902, page 317.

Do you not think the reason why this effect is so seldom observed is that in winter, when it is most likely to occur, it can not be seen unless one has a very free horizon?

On May 2 the sun's declination is about 15° north, consequently at noon of that date, in latitude 42 north, which is a little north of Chicago, the sun is between 62° and 63° above the horizon. As we understand the above description by Mr. Huyette, a ring surrounded the sun; halfway between the lowest and brilliant portion of this ring and the horizon there appeared a bright streak of rainbow tints without any curvature in the streak. The ring near the sun must have been of the nature of a corona, and is not likely to have been more than 5° from the sun. The rainbow arc, located halfway between the horizon and this corona, must, therefore, have been 29° above the horizon, or 34° below the sun. The only suggestion we have to make in explanation of this so-called halo is to call attention to the fact that the solar rays passing through a spherical drop of water will give rise to a number of halos, some of which are called rainbows, whose brilliancy and location depend upon the number of times that the beam of light is reflected within the drop. One reflection gives us the brilliant primary rainbow, whose angular distance from the sun is 138–140°. Two reflections give rise to the secondary rain-

bow of much feebler light, and whose distance from the sun is 126–130°. Three reflections within the drop give a rainbow whose radius is 41° from the sun. Four reflections give the quartenary rainbow whose radius is 44° from the sun. Five reflections give a halo whose radius is 126°. It is only under the most favorable circumstances that any fragments of the third and fourth rainbows can be seen owing to their faintness. Moreover, if the drops are not perfectly spherical these rainbows will appear in some other location than that just given. It does not seem likely that the bit of rainbow seen at Chicago on May 2 was due to reflection and refraction from crystals of ice, but rather from small drops of water, and that it was in fact a case of the visibility of the tertiary rainbow at 41° from the sun. This particular rainbow is not likely to occur in winter, but is then replaced by the various halos formed by ice crystals, as explained in the MONTHLY WEATHER REVIEW for July, 1897.

METEOROLOGY IN CHILE.

A recent letter from Mr. J. Munor Hustady, Director of the Meteorological and Magnetic services of the Bureau of Maritime Territory, Navy Department, Republic of Chile, informs us that the publication of the meteorological observations, taken by the various observatories established on the coast of that country, began with the volume for 1899, and that the two following years have also been published. These three volumes contain the original record of observations three times daily, at the following stations; mostly light-houses:

Station.	Latitude, south.	Longitude, west.	Altitude.
	°	°	*Meters.*
Iquique (Island of Serrano)	20	70	9
Caldera	27	70	23
Island of Chanaral	29	71	48
Tortuga (Coquimbo)	30	71	26
Anjeles (Valparaiso)	33	72	41
Juan Fernandez	34	79	10
Carranza	36	73	33
Tumbes	37	73	91
Santa Maria	37	73	65
Western Mocha	38	74	18
Eastern Mocha	38	74	32
Niebla	40	73	43
Galera	40	74	38
Ancud	42	74	48
The Evangelists	52	75	53
Dungeness	52	68	3

For these sixteen stations, substituting others if one is missing, the three volumes give the same data as far as practicable, viz: the full record day by day of pressure, temperature, wind, relative humidity, cloudiness, and rainfall, as also the monthly summaries of the same observations and, in some cases, of even more frequent observations; namely, the trihourly record for midnight, 3, 6, and 9 a. m., and noon, 3, 6, and 9 p. m., except only in the case of Dungeness for 1901. Unfortunately, serious errors occur in the observations of the light-house at Punta Carranza for 1899 and 1900, but the remaining records seem to be satisfactory. This is, we believe, the first time that complete daily records from South American stations have become accessible to meteorologists.

In addition to the above contribution by the navy, we note that the Astronomical Observatory at Santiago, founded in 1860, has published three volumes of its Annual. The Director, Prof. A. Obrecht, in the first volume of the Annuario, publishes a long memoir on the theory of lunisolar precession, followed by the determination of the latitude and longitude of the observatory, and another on the determination of the force of gravity; and there is a third memoir, by J. Taulis. The volume concludes with the chapter on the meteorology of Santiago de Chile, giving a general summary of the observations made since 1860, and also the monthly mean values, by A. Krahnass, who has had charge of the section of meteorology since October, 1891.

These three volumes form a continuation of the three issued in 1887, or earlier, by Señor I. Vergara, then director of the observatory.

The second volume begins with a photographic method for determining the movement of the terrestrial pole. This is followed by a discussion of the magnetic observations, and that by the table of geographic coordinates.—*C. A.*

EARTHQUAKES IN CALIFORNIA.

[Reported by Prof. A. G. MCADIE.]

Although the subject of earthquakes belongs to geology rather than climatology, the Weather Bureau offices in the State of California have kept a record of shocks during the last few years, and published the results of 1897, 1898, 1899, and 1900 in the bulletin upon the climatology of the State. The Bureau records show that there is no relation between earthquakes and weather, although there is a well-defined belief among the older residents of California that earthquakes are preceded by a spell of sultry weather, and this is even known as "earthquake weather." Some of the most severe earthquakes have occurred when the conditions of weather were in nowise those which are said to be characteristic of quakes.

THE DURATION AND RATE OF RAINFALL.

In the Quarterly Journal of the Royal Meteorological Society, July, 1903, Mr. Joseph Baxendell discusses the records of rainfall obtained by self-registering gages at several stations in England.

At the Fernley Observatory, at Southport, a Halliwell gage was used by Mr. Baxendell himself. The total annual rainfall for 1902 was 25.42 in 199 days, or 640.1 hours, giving an annual mean of 0.0397 inch per hour.

At Croydon Mr. Baldwin Latham used the extensive self-recording gage of his own design, which gave 20.665 inches in 529.35 hours, or a mean annual rate of 0.0390, but this latter rate is abnormally low for Croydon, where the average for four years is 0.0650, for 1879–1882, and, again, 0.0574 for the four years 1898–1901. Mr. Latham also keeps in use one of Halliwell's gages, which furnishes records of equal accuracy.

Mr. Baxendell adds:

> The various self-recording rain gages hitherto in use, however, have unfortunately afforded little assistance in this direction, for most of them either (*a*) have their rims placed at a height of, at any rate, some feet above the ground, which, as instanced below, may vitiate the record of duration to a surprising extent, or (*b*) give "step-by-step" records, quite useless for this purpose, or (*c*) are designed to record on a far too contracted scale to render it practicable to deduce from their traces the duration of light rains with anything approximating to accuracy, while all are usually, in practise, more or less affected by friction and few contain any satisfactory provision for melting snow as it falls. The isolated annual durations of rainfall that are published frequently differ 10 per cent from the truth.

In illustration of this last statement, Baxendell quotes a comparison between gages, some of which appear to have less friction than others, while some are higher than others. It is not quite evident that any gage can give us the absolute truth as compared with hourly personal observations by a large corps of observers.—*C. A.*

THE CAPACITY OF THE AIR FOR AQUEOUS VAPOR.

The Editor frequently has occasion to revise or "edit" the manuscript that is sent him for publication. It follows that he sometimes becomes painfully conscious of the extent to which erroneous views are still held by some of the best men in the service. As one of the fundamental objects of the MONTHLY WEATHER REVIEW is the dissemination of sound views in meteorology and the general education of both regular and

voluntary observers, and the host of teachers and readers interested in meteorology, the Editor will be pardoned if he occasionally calls general attention to matters that seem to need correction.

The following paragraph occurred in an article recently examined at the Weather Bureau:

> When a given mass of air is increased in volume by an access of heat, its capacity for water vapor increases. If a fall of temperature follows, the volume is decreased; condensation sets in, and if the fall of temperature be sufficient, precipitation must occur. But though by this means a large portion of the water vapor of the given mass of air may be precipitated to the earth, the relative humidity of the mass need undergo no special change. That is to say, it may remain as high in the given mass of air, after rain has fallen, as before, unless the temperature again rises; because through shrinkage of volume, less water vapor is needed to keep the percentage of relative humidity high. In those latitudes where, during the winter months, the temperatures are ordinarily low, the volume of air at that season must be considerably less than at other seasons, and its capacity for vapor of water correspondingly diminished.

This quotation contains a number of serious errors, and the sentence could not have been written if its author had seriously considered and accepted the numerous paragraphs bearing on this subject that have appeared from time to time in our columns.

A mass of free air under constant pressure increases its volume by increasing its temperature; but if it is kept under constant volume in a rigid inclosure it increases its elastic pressure against the walls of the inclosure. In the latter case, the accession of heat produces an increase of pressure and temperature; in the former case, it produces an increase of volume and possibly also of temperature. In both cases, there is also an increase in the capacity for water vapor. This latter increase does not depend on either the increase in volume or on the increase in pressure, but on the increase in heat itself. It is not true that the capacity for vapor of water is in proportion to the change in the volume of the air; there may easily be a great increase in capacity with no change in volume—or there may be a great increase in volume but no increase or even a diminution in capacity. The capacity of the free air for moisture depends entirely on the temperature. In fact, the very expression, "Capacity of the air," is itself a mistake. If we give the vapor time enough, it will diffuse among the particles of air just as though there were no air present, but this process is rather slow and usually facilitated by small convection currents, so that in general instead of speaking of the capacity of the air for vapor, we must more properly speak of the capacity of a unit volume of space, or the capacity of a vacuum for vapor.

The capacity of a vacuum for dry air is such that as a pressure of 30 inches and a temperature of 32° F., a cubic foot of space will contain 1.176 ounces of dry air. The capacity of that same vacuous space for vapor at 32° F. is such that when saturated with vapor it will contain 2.11 grains troy, or about 0.004 ounce, and the vapor pressure will be 0.18 inch of the mercurial barometer. If both air and vapor coexist in this cubic foot, we have but to add the above weights and the above pressures, and we find that it contains a total mass of about 1.22 ounces of the mixture at a total pressure of about 30.18 inches. Again, at a temperature of 90°, 1 cubic foot will contain about 1.05 ounces of dry air at a pressure of 30 inches, and about 14.790 grains troy or 0.031 ounce of saturated vapor, exerting a vapor pressure of about 1.41 inches, or 1.08 ounces of the mixture at a total pressure of 31.41 inches. Therefore, by increasing the temperature of the space to such an extent that the air would thereby have its volume increased by about 12 per cent, we have increased the capacity of the space for moisture by about eight times, or about 800 per cent. We have decreased the capacity of the cubic foot to contain dry air, but have increased its capacity to contain moisture. The figures are given in this form, because the ordinary meteorological tables use the cubic foot as a standard, and because the air and the vapor when they attain complete mixture are entirely independent of each other.

But the error of the above-quoted paragraph becomes still more conspicuous if we more strictly follow out the author's erroneous idea that the air, rather than vacuous space, has a capacity for water vapor. The change from 32° to 90° expands the free air from a volume of 1 cubic foot to a volume of about 1.12 cubic feet, whereas it increases the capacity of a cubic foot to contain moisture from 2.11 grains troy up to 14.790 grains, or 700 per cent. Now, as the cubic foot of air has expanded by 12 per cent, we increase the 700 by 12 per cent of itself, or 85, making 785 per cent in all, in order to represent the increased capacity of the original air for vapor, due to the increase both in temperature and volume. It is, therefore, abundantly evident that the idea that the capacity of the air for moisture is in proportion to its increase in volume must be wholly erroneous.—*C. A.*

OCEAN METEOROLOGY.

The above title is really a misnomer, although it has for a long time been in use. It practically means the study of meteorology over the ocean by means of observations made at sea and for the benefit of sailing vessels. But we can not properly have an ocean meteorology and a land meteorology. The atmosphere must be studied as a unit. There is but one meteorology, although there may be ocean observers and land observers, mountain observers and balloon observers, arctic stations and equatorial stations. All these contribute to the general study of the atmosphere which constitutes meteorology.

Early in the history of the Signal Service it was made evident to everyone that the study of our storms and the prediction of the weather could not be successfully prosecuted by means of observations at the surface of the land only; that, in fact, it was absolutely necessary to study both the upper air by means of mountains and balloons and the air above the oceans by means of the ships of the sea. From this point of view the "Bulletin of International Simultaneous Observations" was organized and for the first time in the history of meteorology daily maps for the Northern Hemisphere became possible, and with that began a new epoch in meteorology. Eventually this work was divided, and the Navy Department undertook to care for the ocean while the Weather Bureau cared for the land; but this arrangement had many disadvantages, the publication of the international bulletin and charts ceased, and the study of the atmosphere as a unit was again encumbered with the difficulties attendant upon the want of the daily weather map for the whole earth.

The recent consideration of the great question of the relation of wireless telegraphy to the service of the National Government has incidentally brought about the prospect of a great improvement in the meteorological work of the Government. The Interdepartmental Board on Wireless Telegraphy, recently appointed by President Roosevelt, communicated its unanimous report to him on July 12, and on the 29th he communicated it with his approval to the several departments in turn and directed them to put its recommendations into effect. These latter, therefore, became a part of our departmental regulations, and in so far as they bear on meteorology we quote them from pages 9 and 10 of the "Report of the Interdepartmental Board Appointed by the President to Consider the Entire Question of Wireless Telegraphy in the Service of the National Government, Washington, 1904," as follows:

> That the Weather Bureau of the Department of Agriculture furnish to the Hydrographic Office of the Navy, and to the naval wireless telegraph stations, or to other portions of the public service, such meteorological data as it or they may desire at no cost to them.
>
> That the Department of Agriculture shall continue the work of its meteorological vessel-reporting and storm-warning stations, as now con-

stituted and provided for by law, and continue the control of seacoast telegraph systems, except wireless systems.

That all meteorological reports from vessels of war or commerce, or other sailing craft, now being forwarded direct to the Hydrographic Office of the Navy, shall be forwarded direct to the Weather Bureau.

That the estimates for the support of the Hydrographic Office of the Navy, or any other office of the Navy, for the next and succeeding years, do not contain any provision for the making of ocean forecasts, or for the publication of meteorological data, other than such as may be needed by the Hydrographer of the Navy for use on the pilot and other charts, which data shall be furnished by and credited to the Weather Bureau.

That it is the opinion of this board that no meteorological work need or should be done by any portion of the Navy for the purpose of publication or for the making of forecasts or storm warnings; that all such duties, being purely civil, should devolve upon the Weather Bureau of the Department of Agriculture in accordance with the organic act creating that Bureau.

That the wireless stations of the Navy shall, without charge to the Agricultural Department, receive and promptly transmit to the ocean or to islands, or to other places where the information can be made useful, the storm warnings of the Weather Bureau.

That the Navy Department shall request all vessels having the use of its wireless stations for the receipt of messages to take daily meteorological observations of the weather when within communicating range and to transmit such observations to the Weather Bureau, through naval wireless stations, at least once daily, and transmit observations oftener when there is a marked change in the barometer, and that there shall be no charge against the Agricultural Department for these observations or for the transmission thereof.

C. A.

TEMPERATURE OF THE UPPER ATMOSPHERE.

The most important congress of scientific men that has ever been held will convene in St. Louis under the presidency of Prof. Simon Newcomb on September 18–25. Meteorology will not occupy a very prominent place in this convention, owing to the inability of several distinguished men to accept the invitation to be present; fortunately, however, one of the most distinguished authorities in cosmical physics, Prof. Svante Arrhenius, is to be present, and his address will probably be as important as was the recent publication of his volume of lectures on this subject. During his preliminary travels in this country this eminent scientist seems to have spent some time at the Lick Observatory, where he has written a paper, dated August 1, "On the Physical Nature of the Solar Corona," which is published as No. 58 of the bulletins of the Lick Observatory. In this he shows that both optical, photographic, and bolometric measurements harmonize in showing that the dust particles of the corona, or the drops of liquid particles of molten metals, if such they be, should, by reflecting the sun's light and heat, produce just the phenomenon that we actually observe, and lead to an approximate determination of the total mass within a cubic meter of the substance of the corona. At the close of this bulletin Arrhenius makes the following remark with regard to the temperature of the earth's atmosphere as deduced from analogous calculations relative to the dust in our atmosphere as warmed up by radiation from the sun and the earth, but cooled by their own radiation into space. Nothing is said by him about the conduction of heat between this dust and the adjacent air. If that would be allowed for, the train of argument would be more complete.

It is often supposed that the outermost layers of the sun are of an exceedingly low temperature, due to the adiabatic dilation of the sun's gases from their vertical circulation. Just in the same manner one calculates that the highest strata of the earth's atmosphere should have an exceedingly low temperature.

The spectroscopic evidence for the sun gives a totally different idea of the temperature in its upper strata. This depends upon two circumstances. The radiation of the sun is extraordinarily strong. In the higher strata the density and consequently the heat capacity of the gases sink to the lowest limit. Therefore their expansion, with the lowering of the temperature in ascending, is wholly overwhelmed by the strong radiation, and we may calculate the temperature as determined by the radiation alone, as we have done above, without committing any sensible error.

This probability also holds good for the uppermost extremely thin strata of the earth's atmosphere, especially on the insolated side of the earth. These highest strata contain particles of cosmical dust, supposed to swim by help of the repulsion of their negative electric charges from the electric charge of lower strata. On account of the insolation, the temperature of these dust particles reaches about 57° C. if the temperature of the soil below is about 30° C ,[1] as is easily calculated by the formula of Stefan. Also, on the night side of the earth, by the radiation of the earth, these particles will get a temperature $\sqrt[4]{2}$ times lower than that of the soil. If this is assumed to be 15° C., one finds, for the dust particles in the highest strata, —31° C. Now, one has observed much lower temperatures in lower strata up to about 20 kilometers. It is, therefore, probable that our atmosphere at a certain height reaches a minimum of temperature, and that at higher strata the temperature again increases. Especially is this valid for the insolated part of the earth, on which the highest temperatures, according to this opinion, occur in the highest strata of the atmosphere, and not, as is generally supposed, in the lowest layers of it.

These conclusions are in excellent agreement with the results of the most modern researches, by Teisserenc de Bort and Assmann, of the temperature of the highest investigated strata of the air.

PRECIPITATION IN WISCONSIN.

Mr. W. M. Wilson, Section Director, Milwaukee, Wis., communicates copies of an address on the work of the United States Department of Agriculture and another on the work of the United States Weather Bureau, delivered by him at the Farmers' Institute held at Oconomowoc, Wis., in March, 1902. These are published in Bulletin No. 16 of the Wisconsin Farmers' Institute, and seem to have attracted favorable attention. In the course of the latter address, Mr. Wilson defended the idea that there has been no material change in climate since meteorological records began to be kept in the State of Wisconsin. By this he explained that he referred especially to the annual rainfall and its fluctuations. Thus he finds from the record of thirty-six years at Beloit that during the last ten years the precipitation has been decidedly more than for the first ten years of this period. On the other hand, the record for thirty-nine years at Manitowoc shows that the average precipitation for the last ten years of this period is decidedly less than for the first ten years. It is, therefore, impossible to infer that there has been any change in the annual rainfall for Wisconsin.

A discussion of this subject by those present at the institute brought out the view that this was not a satisfactory conclusion; that, in fact, we may have the same number of inches of rainfall at different periods and yet have a change in the climate. Annual rainfall is not the controlling climatic consideration. The climate may have changed so far as concerns its influence in the growth of corn and other special matters in which farmers are interested. Mr. Reitbrock stated that fifty-five years ago we considered Waterford, 25 miles south of Milwaukee, as the northern limit of the corn belt. But now we know that corn can succeed on the Lake Superior slope of the Penokee range of mountains. A climatic change has been going on, due to the fact that this territory was all forests in former years and the sun could not melt the ice and snow as rapidly as it can now. The ground warms up more rapidly in the southern part of the State since the timber has been all cut off. The value of rainfall to the crops depends upon seasonal distribution and the frequency of showers in the growing season. A few inches of moisture in summer properly distributed may raise a crop where twice the amount in one or two heavy storms may leave us with no crop.—*C. A.*

CANNONADING AGAINST HAIL.

Among the special commissions in the war office of the French Government is one on powder and saltpeter. This commission has lately published a memoir in which there appears, among other things, a report by Angot on the experiments made to prevent hail by cannonading. Although this subject has been settled as far as American practise is concerned, and will doubtless soon be buried and forgotten in

[1] Above a soil of 0° C. it would be 47° C.

Europe, yet some useful information can be drawn from the experiments. The vortex rings of smoke and air fired from the special tubes designed by Steiger and Suschnig at Windisch-Feistritz in southern Styria are very beautiful examples of hydrodynamic phenomena. When the vortex rings are shot vertically upward they, of course, enlarge their diameter and dimensions, while the velocity diminishes, falling to about one-half at the end of the first second, or at an altitude of about 60 or 70 meters, and they finally come to rest at an altitude whose extreme limit is about 350 meters, or 1000 feet, for the largest cannon and the heaviest charge (180 grams) of gunpowder. As the hail falls from much higher elevations than this, we see at once that the smoke vortex can not have a direct action upon it, either mechanical or physical, and we certainly ought not to invoke any mysterious acoustic action following in the line of the ancient myths to the effect that the ringing of bells and the noise of brass bands dissipates lightning and hail.

Dr. E. Vidal proposed to substitute for cannon a form of sky-rocket which is guaranteed to reach 500 meters where a charge of 100 grams of powder can be exploded. These cost much less than the cannon, are simpler and less dangerous. If the cannon do any good, these should do better. They are employed only in some portions of France. In general, Angot shows that a more complete investigation of thunderstorms in all their details must be made in order to demonstrate that cannonading or noises have even the slightest effect. A vote was taken by the members of the conference at Graz, concerning which he says that in this vote the vineyardists were generally in favor of shooting as a means of protection, while the scientific men stood out in a very heavy majority against it. At the close of the conference the members visited Windisch-Feistritz and witnessed the cannonading, but, notwithstanding the ardent conviction with which Mr. Steiger explained his ideas, this exposition was far from producing a favorable effect upon the majority of those present. One could not fail to be impressed with the extreme disproportion between the power of the thunderstorm and the weakness of the means employed to combat it.

After some years of infatuation, the question of cannonading against hail seems now to have arrived at a period of calm and rational discussion. The doubt and scepticism that scientists have shown since the beginning have not diminished, but, on the other hand, have increased among the practical farmers and planters.

PASSAGE OF SOUND THROUGH THE ATMOSPHERE.

Under the above title, Prof. C. V. Boys delivered an instructive lecture before the Royal Meteorological Society on March 18, 1903, and we quote the following from the Quarterly Journal for July:

> In consequence of the gradual decrease of density in the atmosphere upward, light does not travel in a straight horizontal line, but is usually curved to the extent of about one-sixth of the curvature of the earth; in other words, it describes a curve in a vertical plane of about 24,000 miles radius. Thus it is that when the sun and moon have just set geometrically they appear just above the horizon. * * * If the ground is very cold and the temperature increases rapidly upward, a diminution of density becomes intensified and light travels in a still more curved path. * * * When the conditions are reversed, and cold air is resting on warm ground, it sometimes happens that the change of density is sufficiently rapid to cause the beam of light to gradually curve the other way and a mirage results. * * * Unlike light, the velocity of sound is not affected by the density of the air, but it is by the temperature. As, therefore, the temperature usually falls with increasing altitude, the usual condition is that sound travels more quickly near the ground than higher up. This will especially be the case on a warm, quiet, sunny day. If, therefore, on such an occasion it were to happen that the air were uniformly stratified in layers of decreasing temperature, sound would not travel in straight lines, but in curved lines, with the concavity upward. One person, therefore, could not be heard well by another at a distance. * * * On the other hand a quiet night, with the ground colder than the air, tends to reverse the curvature of the sound waves, so that the ground does not form an obstruction and sound is heard well. Above all, a gentle wind, imperceptible on the ground, but increasing gradually upward, adds its velocity to the sound velocity one way and subtracts it to the other, and so *up* the wind, the resultant velocity becomes less upward, and sound rays are strongly bent so as to be concave upward and the ground intercepts all the sound. *Down* the wind, on the other hand, the velocity is greater upward, and rays starting possibly at a number of different inclinations from a source of sound may, after some miles, all converge on a listener, and so he may observe acoustical looming to the amazing extent that we sometimes experience.

THE WEATHER OF THE MONTH.

By Mr. W. B. STOCKMAN, District Forecaster, in charge of Division of Meteorological Records.

PRESSURE.

The distribution of mean atmospheric pressure is graphically shown on Chart VIII and the average values and departures from normal are shown in Tables I and VI.

The mean monthly pressure was highest over the Ohio Valley and Tennessee, east Gulf States, and the southern portion of the South Atlantic States, where the values ranged from 30.05 to 30.09 inches. Over the middle and southern Plateau regions the mean pressure was less than 29.90 inches, with a minimum mean of 29.75 inches at Yuma, Ariz.

The mean pressure for the month was above the normal in the Atlantic and Gulf States, Ohio Valley and Tennessee, lower Lake region, southern portion of the upper Lake region, the upper Mississippi and lower Missouri valleys, southern North Dakota, and the middle and southern slope, and southern portion of the northern slope regions, with the maximum departures ranging from + .05 to + .08 inch over southeastern Florida, the extreme southern portions of Alabama, Mississippi, and Louisiana, southeastern Texas, southern Missouri, northeastern Arkansas, the northern portions of Mississippi and Alabama, western Tennessee, southwestern Virginia, and West Virginia.

Over the Pacific and Plateau regions and the northern portion of North Dakota the mean pressure was below the normal, with the greatest departure over southeastern and northwestern Montana, northern Idaho, eastern and central Washington, north-central California, and north-central Utah, where the departures averaged from — .05 to — .06 inch.

The mean pressure increased over that of June, 1904, in the districts to the southward of a line drawn from the mouth of Chesapeake Bay northwestward to central North Dakota, thence southward to New Mexico, and thence westward to the Pacific Ocean just to the northward of San Francisco. To the northward of this line the mean pressure diminished from that of the preceding month.

TEMPERATURE OF THE AIR.

The distribution of maximum, minimum, and average surface temperatures is graphically shown by the lines on Chart V.

The mean temperature for the month was slightly above the normal on the Massachusetts coast, and in northwestern Montana, northern Idaho, and Washington, except along the coast and in the extreme southeastern portion. In all other sections the mean temperature was below the normal, the greatest changes occurring generally over the central districts, and the southern Plateau, with maximum departures of —4.0° in north-central Nebraska, and —4.1° in central North Dakota.

Maximum temperatures of 90°, or higher, occurred except in portions of New England, North Dakota, the immediate Pacific coast, and the mountain regions; of 100°, or higher, in the central portions of South Carolina, Georgia, Alabama, and Mississippi, Oklahoma, north-central and portions of the Rio

Grande Valley of Texas, southern New Mexico, southern and western Arizona, and interior California, portions of southeastern Washington, eastern Oregon, western Idaho, western Kansas, and southeastern Colorado; and 110°, or higher, in western Arizona and southeastern California.

Freezing temperatures were reported from portions of western Wyoming, eastern Nevada, and upper Michigan.

The average temperatures for the several geographic districts and the departures from the normal values are shown in the following table:

Average temperatures and departures from normal.

Districts.	Number of stations.	Average temperatures for the current month.	Departures for the current month.	Accumulated departures since January 1.	Average departures since January 1.
		°	°	°	°
New England	8	67.4	— 0.7	—14.4	— 2.1
Middle Atlantic	12	73.5	— 1.0	—15.8	— 2.3
South Atlantic	10	78.4	— 0.7	—11.5	— 1.6
Florida Peninsula*	8	80.6	— 0.8	+ 1.5	+ 0.2
East Gulf	9	78.7	— 2.0	— 6.8	— 1.0
West Gulf	7	80.0	— 1.9	+ 2.3	+ 0.3
Ohio Valley and Tennessee	11	74.5	— 1.8	—15.7	— 2.2
Lower Lake	8	69.9	— 1.3	—18.7	— 2.7
Upper Lake	10	66.2	— 1.4	—19.4	— 2.8
North Dakota*	8	65.2	— 3.0	—19.0	— 2.7
Upper Mississippi Valley	11	72.3	— 2.9	—19.8	— 2.8
Missouri Valley	11	72.5	— 2.7	— 8.7	— 1.2
Northern Slope	7	67.9	— 1.6	+ 2.2	+ 0.3
Middle Slope	6	74.5	— 1.5	+ 3.8	+ 0.5
Southern Slope*	6	79.5	— 0.1	+ 9.7	+ 1.4
Southern Plateau*	13	75.8	— 2.2	+ 5.0	+ 0.7
Middle Plateau*	8	70.2	— 1.5	+ 2.3	+ 0.3
Northern Plateau*	12	68.6	+ 0.2	+12.7	+ 1.8
North Pacific	7	60.8	— 0.5	— 0.6	— 0.1
Middle Pacific	5	63.6	— 0.9	+ 2.4	+ 0.3
South Pacific	4	69.8	— 0.9	+ 3.9	+ 0.6

*Regular Weather Bureau and selected voluntary stations.

In Canada.—Prof. R. F. Stupart says:

The temperature was above the average throughout the Maritime Provinces, likewise in Quebec, except in the extreme western portion. It was average, or a little above, from the Okanagan Valley in British Columbia eastward to western Assiniboia, embracing southern Alberta; elsewhere in the Dominion the average was not maintained, the negative departures differing little, and the general deficiency being from 1° to 3°. The chief positive departures occurred in the eastern parts of Quebec and the Maritime Provinces and amounted to from 3° to 5°.

PRECIPITATION.

The distribution of total monthly precipitation is shown on Chart III.

The distribution of precipitation was rather irregular. Over southeastern Georgia there was an excess of over 7 inches, over 4 inches in south-central Kansas, and over 2 inches in north-central New York, southeastern Minnesota, western Iowa, central Nebraska, southwestern Mississippi, southeastern Louisiana, and western Florida. Deficiencies of 2 inches, or slightly more, occurred over the western portion of the Peninsula of Florida, northern Georgia, northwestern South Carolina, southeastern Tennessee, southwestern Virginia, the central and upper Ohio Valley, northeastern Iowa, southwestern Minnesota, central Oklahoma, north-central New Mexico, and portions of southern New England.

HAIL.

The following are the dates on which hail fell in the respective States:

Alabama, 3, 4, 13, 18, 20. Arizona, 25, 26, 28–31. Arkansas, 17, 26. California, 8, 10. Colorado, 1–7, 10, 12, 18, 20, 21, 23, 28, 29, 31. Connecticut, 18, 28. Delaware, 16, 28. District of Columbia, 7. Florida, 2, 3, 18. Georgia, 3, 18, 21, 25, 27. Idaho, 3, 5, 7, 12, 15, 29. Illinois, 1, 6, 11, 12, 14, 15, 20, 22, 23, 27. Indiana, 1, 8, 21, 24. Iowa, 10–14, 17–19, 26, 29. Kansas, 2–6, 8–10, 14, 15, 21, 27. Kentucky, 8, 10, 17, 24, 26, 27. Louisiana, 1, 19. Maine, 2, 29. Maryland, 11, 16, 26, 31. Massachusetts, 2, 5, 16. Michigan, 14, 15, 21–23, 26, 27. Minnesota, 8, 10, 21, 25. Mississippi, 2, 7, 16, 19, 22, 30. Missouri, 11, 12, 15, 21, 27. Montana, 3, 9, 11–13, 27, 28. Nebraska, 1, 4–6, 9, 11, 13, 14, 20, 25–29. Nevada, 8, 23, 30, 31. New Hampshire, 2. New Jersey, 1, 11, 16, 19, 28. New Mexico, 1, 2, 12, 15, 16, 18, 19, 23, 27, 28, 30, 31. New York, 1, 15, 17, 27. North Carolina, 5, 8, 12, 21, 25, 26. North Dakota, 13, 17, 25, 29. Ohio, 1, 6, 17, 18, 19, 22, 25, 27, 28. Oklahoma, 4, 6, 7. Oregon, 8, 10, 11, 15, 21. Pennsylvania, 1, 11, 15, 18, 19, 26. South Carolina, 2, 6, 8, 17, 21, 25, 27, 29–31. South Dakota, 10, 12, 13, 19, 20, 24, 25. Tennessee, 1, 3, 4, 14, 19, 27. Texas, 2, 12. Utah, 1, 5–7, 12, 21, 23, 28, 29. Vermont, 28. Virginia, 1, 7, 8, 11, 12, 16, 19. Washington, 3, 6, 7, 11. West Virginia, 1, 18–20, 22. Wisconsin, 11, 18, 20, 21, 26. Wyoming, 2–5, 8–10, 12, 20–22, 26.

Average precipitation and departure from the normal.

Districts.	Number of stations.	Average.		Departure.	
		Current month.	Percentage of normal.	Current month.	Accumulated since Jan. 1.
		Inches.		*Inches.*	*Inches.*
New England	8	2.33	64	—1.3	— 2.0
Middle Atlantic	12	4.25	100	0.0	— 5.4
South Atlantic	10	5.57	93	—0.4	— 8.4
Florida Peninsula*	8	5.02	77	—1.5	— 1.2
East Gulf	9	6.12	111	+0.6	—12.4
West Gulf	7	3.00	100	0.0	— 3.8
Ohio Valley and Tennessee	11	2.84	69	—1.3	— 5.8
Lower Lake	8	4.05	129	+0.9	+ 2.1
Upper Lake	10	2.80	93	—0.2	— 1.4
North Dakota*	8	1.76	71	—0.7	+ 0.6
Upper Mississippi Valley	11	4.00	108	+0.3	— 1.4
Missouri Valley	11	4.13	111	+0.4	+ 0.6
Northern Slope	7	1.80	106	+0.1	+ 0.4
Middle Slope	6	3.00	103	+0.1	+ 3.0
Southern Slope*	6	1.74	55	—1.4	+ 0.3
Southern Plateau*	13	1.23	86	—0.2	— 2.4
Middle Plateau*	8	0.77	135	+0.2	+ 2.0
Northern Plateau*	12	1.02	142	+0.3	+ 0.2
North Pacific	7	0.94	112	+0.1	+ 0.6
Middle Pacific	5	0.18	225	+0.1	+ 4.6
South Pacific	4	T.	100	0.0	— 0.5

*Regular Weather Bureau and selected voluntary stations.

In Canada.—Professor Stupart says:

The rainfall was above the average over the eastern portion of the Northwest Territories and in Manitoba; also in Ontario east of Lake Huron, north to the Nipissing district and east to an imaginary line drawn north and south from the eastern end of Lake Ontario. In all the remaining portions of the Dominion the average was not maintained, except in one or two isolated cases, such as St. John, N. B., and Victoria, B. C., where it was four-tenths of an inch and one-tenth of an inch above the average, respectively. Welland recorded the highest rainfall for the month, 5.90 inches, this being 2.94 inches in excess of the average; Winnipeg and Toronto closely followed with 5.55 inches and 5.15 inches, respectively.

HUMIDITY.

The relative humidity was normal in the Middle Atlantic and west Gulf States, upper Lake region, and southern Plateau and north Pacific districts; below normal in the South Atlantic States, Florida Peninsula, and North Dakota, and above normal in the remaining districts.

The averages by districts appear in the subjoined table:

Average relative humidity and departures from the normal.

Districts.	Average.	Departure from the normal.	Districts.	Average.	Departure from the normal.
	%			%	
New England	82	+ 2	Missouri Valley	69	+ 3
Middle Atlantic	74	0	Northern Slope	58	+ 6
South Atlantic	78	— 2	Middle Slope	66	+ 6
Florida Peninsula	78	— 2	Southern Slope	60	+ 1
East Gulf	78	0	Southern Plateau	38	0
West Gulf	77	+ 3	Middle Plateau	39	+ 9
Ohio Valley and Tennessee	72	+ 3	Northern Plateau	48	+ 7
Lower Lake	73	+ 4	North Pacific	75	0
Upper Lake	72	0	Middle Pacific	64	+ 2
North Dakota	62	— 4	South Pacific	67	+ 3
Upper Mississippi Valley	71	+ 3			

CLEAR SKY AND CLOUDINESS.

The distribution of clear sky is graphically shown on Chart IV, and the numerical values of average daylight cloudiness, both for individual stations and by geographic districts, appear in Table I.

The cloudiness was normal in the middle slope region; below normal in the Florida Peninsula, North Dakota, Missouri Valley, and northern slope, southern Plateau, and south Pacific districts. In the remaining districts it was above normal, but neither the positive nor negative departures were very marked.

The average cloudiness for the various districts, with departures from the normal, are shown in the following table:

Average cloudiness and departures from the normal.

Districts.	Average.	Departure from the normal.	Districts.	Average.	Departure from the normal.
New England	5.4	+ 0.5	Missouri Valley	4.2	— 0.2
Middle Atlantic	5.2	+ 0.4	Northern Slope	3.6	— 0.2
South Atlantic	5.3	+ 0.3	Middle Slope	4.0	0.0
Florida Peninsula	4.7	— 0.3	Southern Slope	4.2	+ 0.4
East Gulf	5.8	+ 0.8	Southern Plateau	3.0	— 0.3
West Gulf	4.3	+ 0.1	Middle Plateau	2.8	+ 0.8
Ohio Valley and Tennessee	4.8	+ 0.2	Northern Plateau	3.9	+ 0.8
Lower Lake	5.0	+ 0.5	North Pacific	5.0	+ 0.6
Upper Lake	5.0	+ 0.3	Middle Pacific	4.0	+ 0.3
North Dakota	3.6	— 0.7	South Pacific	2.3	— 0.4
Upper Mississippi Valley	4.7	+ 0.4			

ATMOSPHERIC ELECTRICITY.

Numerical statistics relative to auroras and thunderstorms are given in Table IV, which shows the number of stations from which meteorological reports were received, and the number of such stations reporting thunderstorms (T) and auroras (A) in each State and on each day of the month, respectively.

Thunderstorms.—Reports of 9378 thunderstorms were received during the current month as against 8193 in 1903 and 8502 during the preceding month.

The dates on which the number of reports of thunderstorms for the whole country was most numerous were: 5th, 490; 11th, 452; 7th, 442; 6, 417.

Reports were most numerous from: Ohio, 482; Nebraska, 454; Missouri, 388; Florida, 373; New York, 364; Illinois, 357.

Auroras.—The evenings on which bright moonlight must have interfered with observations of faint auroras are assumed to be the four preceding and following the dates of full moon, viz, July 23 to 31, inclusive.

In Canada: Thunderstorms were reported from Sydney, 20; Halifax, 10, 20; Grand Manan, 1, 12, 20; Yarmouth, 2; Charlottetown, 20, 21; Quebec, 1, 11, 12, 16, 19, 26–29; Montreal, 12, 19, 28, 31; Ottawa, 1, 5; Kingston, 5, 9, 12, 18; Toronto, 12, 28, 31; White River, 12, 15; Port Stanley, 1, 4, 5, 9, 12, 17–19, 21–23, 28, 31; Saugeen, 17, 26; Parry Sound, 9, 12, 15, 18, 24, 27, 31; Port Arthur, 11, 17, 18, 20, 21; Winnipeg, 2, 9, 17–20, 24, 29; Minnedosa, 2, 11, 14, 18, 29; Qu'Appelle, 12, 13, 16, 28–30; Medicine Hat, 10, 15, 16, 29; Swift Current, 12, 15, 28, 29; Calgary, 7; Banff, 11, 22; Prince Albert, 1, 10, 15, 16, 18, 24; Barkerville, 4, 26; Port Simpson, 26.

Auroras were reported from Halifax, 9; Father Point, 6; Minnedosa, 7; Swift Current, 5, 6; Prince Albert, 6; Battleford, 6.

WIND.

The maximum wind velocity at each Weather Bureau station for a period of five minutes is given in Table I, which also gives the altitude of Weather Bureau anemometers above ground.

Following are the velocities of 50 miles and over per hour registered during the month:

Maximum wind velocities.

Stations.	Date.	Velocity.	Direction.	Stations.	Date.	Velocity.	Direction.
Amarillo, Tex	7	52	nw.	Point Reyes Light, Cal.	3	57	nw.
Columbus, Ohio	18	50	sw.	Do	4	52	nw.
Hatteras, N. C	19	60	n.	Do	15	50	nw.
Lewiston, Idaho	28	50	w.	Do	16	63	nw.
Modena, Utah	15	51	sw.	Do	17	58	nw.
Mount Tamalpais, Cal.	7	50	nw.	Do	18	50	nw.
Do	14	54	nw.	Do	27	62	nw.
Do	28	59	nw.	Do	28	58	nw.
North Head, Wash.	14	53	se.	St. Louis, Mo	11	55	w.
Do	16	62	se.	Yellowstone Park, Wyo.	14	52	sw.

DESCRIPTION OF TABLES AND CHARTS.

By Mr. W. B. STOCKMAN, District Forecaster, in charge of Division of Meteorological Records.

For description of tables and charts see page 136 of REVIEW for March, 1904.

TABLE I.—*Climatological data for Weather Bureau stations, July, 1904.*

Stations.	Elevation of instruments.			Pressure, in inches.			Temperature of the air, in degrees Fahrenheit.										Mean wet thermometer.	Mean temperature of the dew-point.	Mean relative humidity, per cent.	Precipitation, in inches.			Wind.				Clear days.	Partly cloudy days.	Cloudy days.	Average cloudiness, tenths.	Total snowfall.
	Barometer above sea level, feet.	Thermometers above ground.	Anemometer above ground.	Actual, reduced to mean of 24 hours.	Sea level, reduced to mean of 24 hrs.	Departure from normal.	Mean max. + mean min. ÷ 2.	Departure from normal.	Maximum.	Date.	Mean maximum.	Minimum.	Date.	Mean minimum.	Greatest daily range.					Total.	Departure from normal.	Days with .01, or more.	Total movement, miles.	Prevailing direction.	Maximum velocity. Miles per hour.	Maximum velocity. Direction.	Maximum velocity. Date.					
New England.							67.4	— 0.7									82			2.33	— 1.3									5.4	
Eastport	76	69	82	29.88	29.96	+ .03	59.7	— 0.7	85	8	68	49	10	52	33	56	54	86		2.10	— 1.8	10	6,597	s.	36	e.	24	8	13	10	6.1	
Portland, Me.	103	81	117	29.85	29.97	+ .02	66.6	— 1.9	87	20	75	52	4	59	24	61	58	78		1.63	— 1.9	9	6,018	s.	24	sw.	29	7	10	14	6.0	
Concord	298	70	79	29.66	29.98	+ .02	68.9	— 1.0	93	19	80	45	4	58	35	.....	.....	.....		3.42	— 0.5	12	3,424	se.	22	w.	2	7	15	9	5.9	
Northfield	876	16	60	29.06	29.99	+ .05	64.0	— 1.1	89	19	76	41	4	52	37	61	58	78		3.53	— 0.2	16	5,097	s.	35	sw.	1	2	18	11	6.3	
Boston	125	115	181	29.86	29.99	+ .03	71.4	+ 0.1	89	31	79	56	3	64	26	65	62	76		1.23	— 2.2	10	6,950	sw.	34	w.	2	8	16	7	5.4	
Nantucket	12	43	82	29.99	30.00	+ .02	67.9	+ 0.7	85	20	74	57	4	62	19	65	63	90		2.09	— 0.4	9	8,011	s.	30	e.	23	10	17	4	4.6	
Block Island	26	11	46	29.98	30.01	+ .04	68.2	— 0.2	80	20	74	58	4	63	17	65	63	88		2.14	— 1.0	11	10,098	sw.	48	ne.	28	13	16	2	4.1	
Narragansett	.....	9	38	.....	.....	.....	68.4	— 1.8	88	20	75	50	4	62	26	.....	.....	.....		.....	.....	.....	.....	s.	.....	.....	20	5	6	.....	.....	
New Haven	106	116	154	29.89	30.00	+ .03	71.2	— 0.6	93	19	79	51	4	63	26	65	62	75		2.08	— 2.9	15	6,103	s.	32	sw.	29	11	13	7	4.8	
Mid. Atlantic States.							73.5	— 1.0										74		4.25	0.0									5.2	
Albany	97	102	115	29.88	29.98	+ .02	72.5	+ 0.1	97	19	82	54	4	63	31	65	61	73		2.96	— 1.0	13	5,435	s.	25	s.	12	12	11	8	4.9	
Binghamton	875	79	90	29.08	30.00	+ .03	68.4	— 0.3	91	19	79	46	14	58	35	.....	.....	.....		4.73	+ 1.5	14	3,871	w.	28	sw.	19	8	14	9	5.6	
New York	314	108	350	29.67	30.00	+ .02	73.6	+ 0.1	93	19	80	60	3	67	21	67	64	77		4.31	0.0	15	7,629	s.	41	nw.	2	11	10	10	5.3	
Harrisburg	374	94	104	29.62	30.01	+ .03	73.2	+ 0.3	94	18	82	55	3	64	28	66	63	76		4.76	+ 0.5	16	3,745	w.	30	w.	21	10	10	11	5.7	
Philadelphia	117	116	184	29.89	30.01	+ .03	74.8	— 0.9	96	19	82	60	3	67	24	67	63	70		3.82	— 0.4	13	5,488	sw.	30	ne.	18	10	11	10	5.3	
Scranton	805	111	119	29.17	30.02	+ .04	70.4	.....	92	19	80	48	14	61	34	64	60	73		5.94	.....	14	4,670	sw.	28	sw.	28	8	11	12	5.9	
Atlantic City	52	39	48	29.96	30.01	+ .03	72.2	+ 0.3	93	19	78	57	3	66	24	67	65	80		2.52	— 0.9	13	5,483	sw.	30	w.	5	9	15	7	5.3	
Cape May	17	47	51	30.02	30.04	+ .06	71.8	— 1.8	91	19	77	60	14	67	22	68	.....	.....		3.98	+ 0.6	16	4,832	s.	29	w.	18	9	19	3	5.0	
Baltimore	123	69	117	29.88	30.00	+ .02	75.6	— 1.6	97	19	84	57	3	67	27	67	64	71		4.58	— 0.1	15	4,629	nw.	40	w.	5	8	11	12	6.1	
Washington	112	59	76	29.90	30.02	+ .02	74.4	— 2.4	92	19	83	57	3	65	26	68	65	61		6.25	+ 1.7	20	3,844	nw.	30	nw.	1	9	15	7	5.2	
Cape Henry	18	11	58	30.01	30.03	+ .04	76.2	— 0.8	93	19	83	66	15	70	23	.....	.....	.....		5.39	— 0.2	14	7,782	sw.	44	w.	12	6	13	12	6.2	
Lynchburg	681	83	88	29.31	30.04	+ .03	75.6	— 1.9	98	18	86	56	3	65	30	68	65	74		3.74	— 0.2	11	2,273	sw.	25	nw.	11	17	11	3	3.8	
Norfolk	91	102	111	29.94	30.04	+ .04	77.2	— 1.3	94	19	86	65	25	69	26	71	68	80		6.56	+ 0.6	12	5,442	s.	35	nw.	12	7	16	8	5.5	
Richmond	144	82	90	29.88	30.03	+ .02	77.7	.....	98	19	88	62	3	68	26	.....	.....	.....		6.25	.....	14	3,578	sw.	28	sw.	12	11	16	4	4.5	
Wytheville	2,293	40	47	27.73	30.09	+ .08	69.4	— 2.9	89	18	80	47	3	58	32	64	62	82		1.64	— 2.1	17	2,835	w.	17	sw.	12	14	13	4	4.2	
S. Atlantic States.							73.4	— 0.7										73		5.57	0.4									5.3	
Asheville	2,255	53	75	27.78	30.06	+ .04	70.7	— 0.8	90	19	82	51	26	60	32	63	60	75		2.61	— 1.9	13	3,006	n.	24	nw.	12	6	15	10	5.7	
Charlotte	773	68	76	29.23	30.05	+ .03	77.6	— 0.6	98	19	88	60	26	68	25	69	66	75		6.20	+ 0.7	17	3,544	s.	36	s.	16	9	18	4	4.7	
Hatteras	11	12	47	30.04	30.05	+ .04	77.8	— 0.1	90	20	84	68	19	72	18	73	71	83		6.11	— 0.3	15	8,993	sw.	60	n.	19	17	7	7	4.3	
Raleigh	376	71	79	29.64	30.03	+ .01	77.8	+ 0.7	96	19	88	63	14	68	26	70	67	77		3.48	— 1.5	14	3,751	sw.	34	n.	8	7	17	7	5.7	
Wilmington	78	82	90	29.95	30.03	+ .02	79.1	— 0.6	96	20	87	68	12	71	24	72	71	84		6.11	— 1.1	18	5,053	sw.	30	w.	12	4	21	6	5.7	
Charleston	48	14	92	30.02	30.07	+ .04	80.1	— 1.7	95	20	87	67	26	74	21	73	71	79		6.36	— 1.2	14	6,515	s.	48	s.	2	3	22	6	6.0	
Columbia, S. C.	351	167	175	29.67	30.04	+ .02	79.4	— 1.2	98	20	89	62	25	69	25	70	67	74		3.21	— 2.4	16	5,235	sw.	40	w.	7	6	15	10	6.1	
Augusta	180	89	97	29.85	30.04	+ .02	81.2	+ 0.1	97	20	92	61	25	71	30	71	67	69		3.23	— 2.0	9	3,889	s.	48	se.	21	11	16	4	4.5	
Savannah	65	81	89	30.00	30.07	+ .04	80.4	— 1.5	97	20	89	68	13	72	24	72	71	82		13.14	+ 7.3	14	5,211	sw.	36	w.	22	9	18	4	5.1	
Jacksonville	43	101	129	30.02	30.07	+ .04	80.4	— 1.7	94	20	88	69	10	73	20	73	71	79		5.25	— 1.2	13	6,832	sw.	47	sw.	22	14	7	10	4.8	
Florida Peninsula.							80.9	— 1.1										78		3.54	2.3									4.7	
Jupiter	28	10	48	30.06	30.09	+ .06	80.0	— 0.8	91	22	86	68	22	74	23	74	72	80		4.38	— 0.8	14	6,354	se.	36	se.	28	7	21	3	5.3	
Key West	22	10	53	30.04	30.06	+ .03	82.2	— 1.7	89	23	87	72	28	77	16	75	72	72		1.40	— 2.4	11	6,750	se.	28	se.	28	18	13	0	3.7	
Sand Key	25	40	71	30.01	30.04	.....	80.8	.....	93	20	85	66	14	77	19	.....	.....	.....		1.97	.....	11	9,811	e.	49	se.	14	10	16	5	4.5	
Tampa	34	60	67	30.04	30.08	+ .04	80.6	— 0.8	93	7	89	68	15	72	24	73	71	81		4.85	— 3.3	17	4,002	se.	30	e.	7	1	30	0	5.4	
East Gulf States.							78.7	— 2.0										78		6.12	+ 0.6									5.2	
Atlanta	1,174	190	216	28.85	30.06	+ .04	77.0	— 1.4	94	20	86	60	26	68	23	68	64	70		2.67	— 2.2	9	6,013	nw.	42	w.	9	5	19	7	6.1	
Macon	370	93	99	29.67	30.06	+ .04	80.2	.....	96	20	90	64	26	70	25	.....	.....	.....		3.28	.....	12	3,769	s.	34	sw.	21	5	9	17	6.7	
Pensacola	56	79	96	30.01	30.07	+ .06	79.4	— 1.4	90	18	85	69	11	74	18	.....	.....	.....		9.75	+ 3.0	15	5,829	nw.	39	sw.	11	9	14	8	5.4	
Birmingham	709	136	143	29.31	30.07	+ .06	78.1	— 2.6	95	2	88	61	26	68	25	.....	.....	.....		5.22	— 0.2	14	3,652	sw.	45	se.	3	10	14	7	5.1	
Mobile	57	88	96	30.01	30.07	+ .06	78.7	— 2.5	90	18	86	65	13	72	22	73	70	79		7.98	+ 1.4	18	4,080	s.	30	nw.	13	2	20	9	6.1	
Montgomery	223	100	112	29.82	30.04	+ .02	79.8	— 1.7	96	18	89	64	26	70	25	72	69	79		3.91	— 0.6	11	3,946	sw.	36	sw.	5	8	20	3	4.8	
Meridian	375	84	93	29.67	30.05	+ .03	77.6	— 2.4	94	1	88	58	25	68	27	.....	.....	.....		4.42	— 1.0	15	2,969	sw.	23	n.	9	7	16	8	5.6	
Vicksburg	247	62	74	29.77	30.03	+ .03	78.4	— 2.9	92	1	87	67	31	69	21	72	70	83		6.49	+ 2.0	16	3,885	s.	30	nw.	21	9	14	8	5.5	
New Orleans	51	88	121	30.01	30.06	+ .06	80.7	— 1.5	92	1	88	70	5	74	18	74	71	79		8.49	+ 2.0	16	4,632	s.	36	n.	12	1	18	12	6.8	
West Gulf States.							80.0	— 1.9										77		3.00	0.0									4.3	
Shreveport	249	77	84	29.76	30.02	+ .04	80.8	— 1.7	95	1	90	67	28	71	25	72	70	77		2.89	— 0.6	10	3,929	se.	31	ne.	10	14	11	6	4.4	
Fort Smith	457	79	94	29.52	29.99	+ .02	78.7	— 1.3	95	13	89	63	27	69	26	71	69	76		3.09	— 1.4	11	4,728	e.	42	nw.	9	10	21	0	3.8	
Little Rock	357	93	100	29.65	30.02	+ .03	78.6	— 1.7	93	15	88	65	3	70	23	71	69	78		3.69	— 0.3	13	3,902	s.	34	nw.	9	11	16	4	4.7	
Corpus Christi	20	48	53	29.98	30.00	+ .04	80.2	— 1.5	89	22	85	70	2	75	16	75	72	80		1.93	+ 0.6	7	8,583	se.	34	se.	2	9	14	8	5.4	
Fort Worth	670	106	114	29.30	30.00	+ .04	81.8	.....	103	12	92	67	25	72	35	.....	.....	.....		2.15	.....	9	8,334	s.	38	sw.	3	26	4	1	2.4	
Galveston	54	106	112	29.98	30.04	+ .06	81.0	— 2.9	87	14	85	68	24	77	14	75	72	76		3.41	+ 0.3	11	7,284	s.	34	ne.	27	18	9	4	3.8	
Palestine	510	73	79	29.50	30.02	+ .05	79.4	— 2.1	92	1	88	66	24	70	22	72	70	78		2.52	— 0.1	11	3,321	s.	28	nw.	22	7	19	5	4.8	
San Antonio	701	80	91	29.27	29.98	+ .03	81.0	— 2.3	94	12	91	67	21	71	25	72	68	74		3.50	+ 1.3	8	4,941	se.	21	s.	20	15	11	5	4.2	
Taylor	583	55	63	29.40	30.01	+ .05	79.8	.....	95	12	89	67	3	70	26	.....	.....	.....		4.54	.....	6	6,047	s.	30	s.	3	6	20	5	5.5	
Ohio Val. and Tenn.							74.5	— 1.8										72		2.84	— 1.3									4.8	
Chattanooga	762	106	112	29.28	30.07	+ .05	76.6	— 1.2	95	19	87	60	26	67	29	68	65	74		2.09	— 2.1	13	3,834	w.	39	nw.	21	10	13	8	5.5	
Knoxville	1,004	35	88	29.02	30.05	+ .03	75.3	— 1.1	96	19	86	56	26	64	31	66	63	74		2.50	— 1.8	14	4,053	sw.	36	sw.	4	13	15	3	4.1	
Memphis	397	146	154	29.63	30.05	+ .05	78.0	— 2.7	91	17	86	66	27	70	19	72	70	82		4.44	+ 0.9	13	5,083	sw.	38	sw.	11	15	10	6	4.3	
Nashville	546	122	134	29.48	30.06	+ .05	76.4	— 2.9	92	30	86	60	25	67	28	69	66	74		4.62	+ 0.3	13	3,691	nw.	33	n.	19	11	16	4	4.7	
Lexington	989	75	102	28.99	30.04	+ .03	73.9	— 1.5	92	18	84	55	2	64	27	.....	.....	.....		3.13	— 2.0	13	5,730	sw.	42	w.	4	17	11	3	3.7	
Louisville	525	114	136	29.47	30.05	+ .05	76.8	— 1.6	95	19	87	57	2	67	28	67	63	69		1.70	— 2.1	12	4,862	sw.	32	w.	11	8	16	7	5.2	
Evansville	431	72	82	29.56	30.02	+ .02	76.2	.....	94	18	85	57	2	67	26	.....	.....	.....		7.98	.....	12	4,414	sw.	34	nw.	8	16	12	3	3.7	
Indianapolis	822	154	164	29.15	30.02	+ .03	73.2	— 3.0	91	17	82	50	2	64	25	65	60	68		3.63	— 0.6	10	6,097	s.	30	sw.	4	11	18	2	4.4	
Cincinnati	628	152	160	29.36	30.02	+ .02	75.5	— 1.9	94	17	85	53	2	66	28	65	59	61		0.80	— 2.6	6	4,314	sw.	22	w.	8	7	20	4	5.3	
Columbus	824	173	190	29.16	30.02	+ .02	73.4	— 1.5	94	17	84	54	2	63	27	64	60	70		2.48	— 0.7	10	6,455	sw.	50	sw.	18	8	14	9	5.4	
Pittsburg	842	336	352	29.12	30.00	.00	72.8	— 2.2	90	17	81	54	3	64	25	64	60	68		2.72	— 2.0	10	5,543	nw.	31	sw.	4	6	17	8	5.8	
Parkersburg	638	77	84	29.38	30.07	+ .06	73.6	— 1.2	93	31	84	51	3	63	30	66	63	73		1.96	— 2.7	15	3,166	sw.	45	nw.	19	14	12	5	4.1	
Elkins	1,940	41	50	28.05	30.06	+ .05	68.6	— 1.2	88	18	80	47	3	57	38	63	61	84		4.07	— 0.1	12	2,096	n.	27	w.	19	5	15	11	6.4	
Lower Lake Region.							69.9	— 1.3										73		4.05	+ 0.9									5.0	
Buffalo	767	178	206	29.16	29.98	+ .01	67.9	— 1.8	82	8	74	51	3	62	21	63	60	76		3.87	+ 0.7	12	8,689	sw.	41	sw.	9	6	12	13	6.3	
Oswego	335	76	91	29.61	29.97	+ .01	66.8	— 2.2	88	31	71	49	2	59	32	62	60	79		5.75	+ 2.6	14	5,682	s.	23	s.	4	9	18	4	4.8	
Rochester	523	81	102	29.43	29.99	+ .02	69.4	— 1.0	91	17	79	50	3	60	32	62	59	74		4.20	+ 1.2	9	5,218	sw.	28	sw.	31	7	14	10	5.9	
Syracuse	597	97	113	29.35	29.98	+ .01	68.6	.....	90	19	77	51	2	60	30	.....	.....	.....		3.80	.....	13	7,179	s.	30	s.	4	11	12	8	5.0	
Erie	713	92	102	29.24	29.99	+ .01	69.4	— 1.6	90	17	76	52	3	63	24	64	60	71		3.68	+ 0.9	11	6,159	s.	30	sw.	4	12	10	9	5.3	
Cleveland	762	190	201	29.20	30.00	+ .01	70.3	— 1.2	90	17	77	55	1	63	26	64	61	74		4.63	+ 1.1	14	8,348	s.	44	n.	22	14	9	8	4.3	
Sandusky	629	62	70	29.33	30.00	+ .01	71.8	— 1.3	93	17	80	54	3	64	27	.....	.....	.....		4.48	+ 1.4	12	5,040	sw.	25	nw.	17	16	9	6	3.9	
Toledo	628	120	127	29.33	30.00	+ .01	72.3	— 1.1	93	18	81	53	3	63	26	63	59	66		2.85	— 0.1	8	6,533	sw.	34	sw.	4	16	10	5	3.9	
Detroit	730	153	193	29.21	29.99	+ .01	71.2	— 0.4	96	17	80	51	3	63	27	63	59	69		2.94	— 0.4	11	7,179	sw.	33	sw.	4	7	15	9	5.4	
Upper Lake Region.							66.2	— 1.4										72		2.80	— 0.2									5.0	
Alpena	609	63	80	29.32	29.99	+ .02	64.6	— 0.7	94	17	74	45	3	55	31	59	55	72		1.04	— 1.9	9	6,714	nw.	32	se.	12	11	14	6	4.8	
Escanaba	612	40	48	29.30	29.96	— .01	64.2	— 2.5	86	17	74	46	1	55	28	60	57	78		4.52	+ 1.3	14	5,313	s.	32	nw.	21	6	15	10	5.5	
Grand Rapids	707	127	165	29.23	29.99	+ .01	69.9	— 3.4	91	17	79	48	2	60	27	61	56	65		2.24	0.0	11	7,314	sw.	42	w.	4	11	12	8	4.9	
Houghton	668	66	74	29.22	29.94	— .02	63.8	.....	93	18	74	42	1	53	34	.....	.....	.....		1.97	.....	11	5,158	w.	29	w.	31	17	8	6	4.3	
Marquette	734	76	116	29.17	29.97	+ .01	62.8	— 2.1	94	18	71	45	7	54	33	56	51	68		3.01	0.0	12	6,972	nw.	43	sw.	30	12	10	9	5.0	
Port Huron	638	70	120	29.33	30.02	+ .04	68.3	— 0.2	95	17	77	44	3	59	28	62	59	73		2.34	0.0	11	6,932	sw.	44	nw.	18	12	12	7	4.9	
Sault Ste. Marie	614	40	61	29.28	29.94	— .03	60.8	— 1.0	87	18	71	44	3	50	36	57	53	78		2.57	— 0.4	11	5,416	w.	29	nw.	1	13	12	6	4.5	
Chicago	823	241	274	29.14	30.01	+ .03	71.0	— 1.0	94	17	78	53	1	64	23	62	58	67		2.76	— 0.7	10	10,739	sw.	44	se.	27	8	16	7	5.1	
Milwaukee	681	124	142	29.27	30.00	+ .03	69.9	+ 0.7	94	17	78	50	1	62	25	64	61	76		1.89	— 1.2	9	7,300	sw.	36	sw.	14	11	7	13	5.6	
Green Bay	617	49	86	29.31	29.97	.00	68.4	— 1.6	92	16	78	48	1	59	29	62	58	73		3.83	+ 0.4	10	6,857	sw.	36	ne.	11	7	13	11	5.9	
Duluth	1,133	11	47	28.74	29.95	.00	62.2	— 2.5	84	17	71	46	23	53	28	56	52	72		3.82	+ 0.1	11	8,759	ne.	37	nw.	18	14	11	6	4.8	

TABLE I.—*Climatological data for Weather Bureau stations, July, 1904*—Continued.

Stations.	Elevation of instruments.			Pressure, in inches.			Temperature of the air, in degrees Fahrenheit.								Mean wet thermometer.	Mean temperature of the dew-point.	Mean relative humidity, per cent.	Precipitation, in inches.			Wind.					Clear days.	Partly cloudy days.	Cloudy days.	Average cloudiness, tenths.	Total snowfall.
	Barometer above sea level, feet.	Thermometers above ground.	Anemometer above ground.	Actual, reduced to mean of 24 hours.	Sea level, reduced to mean of 24 hrs.	Departure from normal.	Mean max. + mean min. ÷ 2.	Departure from normal.	Maximum.	Date.	Mean maximum.	Minimum.	Date.	Mean minimum.	Greatest daily range.			Total.	Departure from normal.	Days with .01, or more.	Total movement, miles.	Prevailing direction.	Maximum velocity. Miles per hour.	Direction.	Date.				
North Dakota.							66.7	— 1.9									62	1.68	— 1.1									3.6	
Moorhead	935	54	60	28.96	29.96	+ .02	64.9	— 2.7	89	16	76	44	28	53	36	59	55	72	3.58	— 0.3	9	6,508	se.	28	sw.	30	17	11	3	3.4	
Bismarck	1,674	16	29	28.20	29.96	+ .03	65.4	— 4.1	95	15	78	45	26	53	41	58	52	64	0.90	— 1.5	9	7,278	se.	41	s.	17	19	11	1	3.4	
Williston	1,875	14	44	27.94	29.88	— .04	69.7	+ 1.2	98	23	85	45	27	54	46	55	45	50	0.56	— 1.6	5	8,485	se.	48	n.	10	15	9	7	4.0	
Upper Miss. Valley.							72.3	— 2.9									71	4.00	+ 0.3									4.7	
Minneapolis		99	208				68.4	— 3.2	92	16	76	53	2	60	27				4.78	+ 1.0	13	8,191	w.	45	e.	13	7	14	10		
St. Paul	837	171	179	29.06	29.95	.00	68.5	— 3.0	92	16	76	52	2	61	29	61	57	71	5.73	+ 2.4	13	6,028	nw.	36	nw.	30	17	6	8	4.0	
La Crosse	714	71	87	29.23	29.98	+ .02	69.5	— 3.4	92	18	80	48	1	60	31				2.05	— 2.0	13	4,566	s.	31	w.	17	8	18	5	4.9	
Davenport	606	71	79	29.34	29.97	.00	72.9	— 2.1	92	16	82	52	2	64	28	65	61	71	3.34	— 0.3	12	4,731	sw.	36	sw.	3	12	13	6	4.5	
Des Moines	861	84	99	29.09	30.00	+ .04	71.6	— 2.9	93	18	81	54	2	62	30	65	61	72	6.94	+ 3.4	11	5,357	sw.	34	sw.	14	13	12	6	4.7	
Dubuque	698	100	117	29.26	29.99	+ .02	71.2	— 3.1	94	17	81	47	2	62	28	63	58	66	1.86	— 2.4	11	4,481	nw.	29	s.	3	13	12	6	4.7	
Keokuk	614	63	78	29.33	29.98	.00	74.0	— 2.9	93	30	83	54	2	65	26	66	63	71	4.48	+ 0.4	8	4,908	sw.	32	sw.	3	14	14	3	3.8	
Cairo	356	87	93	29.66	30.04	+ .04	76.3	— 2.6	92	18	85	62	24	68	23	70	67	78	4.20	+ 0.8	13	4,302	s.	40	sw.	8	7	15	9	5.7	
Springfield, Ill	644	82	93	29.33	30.00	+ .02	73.4	— 2.6	91	16	83	53	2	64	29	66	62	72	4.25	+ 1.5	9	5,743	s.	34	sw.	11	13	12	6	4.7	
Hannibal	534	75	109	29.44	30.00	+ .02	73.8	— 2.9	94	30	83	54	24	65	27				3.26	— 1.3	8	5,853	sw.	37	nw.	11	10	13	8	5.3	
St. Louis	567	208	217	29.41	30.01	+ .02	76.0	— 2.8	93	16	84	59	2	68	27	68	64	70	3.09	— 0.7	9	7,089	sw.	55	w.	11	13	10	8	4.8	
Missouri Valley.							72.5	— 2.7									69	4.13	+ 0.4									4.2	
Columbia, Mo	784	11	84	29.17	29.99	+ .01	73.8	— 2.6	94	30	84	52	24	64	28				2.42	— 1.8	9	4,479	s.	26	nw.	11	13	15	3	4.0	
Kansas City	963	78	95	29.00	30.04	+ .03	75.0	— 2.5	92	30	83	61	23	67	23	67	64	72	6.25	+ 2.0	12	5,226	se.	37	nw.	21	13	12	6	4.5	
Springfield, Mo	1,324	98	104	28.65	30.03	+ .05	74.2	— 1.5	88	15	82	61	24	66	22	68	65	77	4.02	— 0.3	14	6,070	s.	38	w.	3	18	9	4	3.5	
Topeka		85	89				75.0	— 2.4	95	30	84	57	24	66	26				6.37	+ 1.4	14	5,630	s.	46	n.	21	15	12	4	3.7	
Lincoln	1,189	75	84	28.70	29.94	— .01	72.7	— 4.1	93	29	83	53	23	63	29	66	62	72	5.12	+ 1.3	16	6,585	se.	48	sw.	13	12	12	7	4.8	
Omaha	1,105	115	121	28.81	29.96	+ .01	73.1	— 3.1	93	18	82	54	23	64	27	66	62	70	3.15	— 1.6	14	5,154	s.	36	w.	11	12	14	5	4.6	
Valentine	2,598	47	54	27.29	29.96	+ .03	69.3	— 4.0	95	29	82	50	7	57	35	60	55	66	6.08	+ 3.6	11	7,729	s.	48	nw.	10	12	14	5	4.3	
Sioux City	1,135	96	164	28.75	29.94	— .01	71.4	— 2.9	94	16	81	49	23	62	27				5.49	+ 2.1	14	8,275	se.	42	nw.	3	15	9	7	4.4	
Pierre	1,572	43	50	28.30	29.93	.00	73.2	— 1.4	100	15	85	53	1	61	36	61	53	56	1.46	— 0.7	7	6,210	se.	40	s.	15	14	11	6	4.5	
Huron	1,306	56	67	28.58	29.96	+ .02	68.6	— 2.3	93	29	81	44	1	56	37	60	55	67	2.60	— 0.5	10	8,031	se.	40	s.	13	12	13	6	4.2	
Yankton	1,233	42	49	28.63	29.92	— .02	71.1	— 2.5	94	16	82	45	23	60	35				2.50	— 1.3	9	4,964	se.	36	n.	25	18	9	4	3.5	
Northern Slope.							67.9	— 1.6									58	1.80	+ 0.1									3.6	
Havre	2,505	11	44	27.30	29.88	— .03	69.1	+ 1.6	100	22	84	44	19	54	42	55	46	51	0.43	— 1.8	4	6,518	e.	40	sw.	15	19	11	1	2.9	
Miles City	2,371	42	50	27.41	29.86	— .06	72.0	— 1.7	98	23	85	52	27	59	34	65	61	71	0.74	— 0.6	5	4,982	w.	36	sw.	23	21	10	0	2.7	
Helena	4,110	88	94	25.81	29.92	— .01	66.8	— 0.4	91	22	79	47	18	54	34	52	41	45	1.39	+ 0.3	8	6,036	sw.	38	sw.	22	11	14	6	4.5	
Kalispell	2,965	45	51	26.88	29.88	— .05	65.2	.....	94	22	80	40	19	51	41	52	42	52	0.78	.....	6	4,822	w.	36	sw.	29	20	8	3	3.1	
Rapid City	3,234	46	50	26.60	29.89	— .04	68.4	— 2.9	98	15	81	45	8	56	38	58	52	58	1.84	+ 0.2	10	5,534	se.	38	se.	12	18	9	4	3.4	
Cheyenne	6,088	56	64	24.10	29.94	+ .02	63.2	— 3.7	87	15	76	37	7	50	34	53	46	60	2.00	+ 0.2	13	6,323	s.	39	nw.	2	17	9	5	4.0	
Lander	5,372	26	36	24.69	29.93	+ .01	64.4	— 1.6	88	23	80	39	6	48	45	53	46	60	1.31	+ 0.4	7	2,463	sw.	35	sw.	12	11	18	2	4.2	
Yellowstone Park	6,200	11	47	.....	.....	.....	58.3	.....	81	26	74	34	16	43	39	.....	.....	.....	1.11	.....	13	5,265	sw.	52	sw.	14	.....	.....	.....	.....	
North Platte	2,821	43	52	27.09	29.96	+ .03	71.2	— 2.3	96	29	84	51	8	58	34	63	59	70	4.90	+ 2.2	10	6,024	se.	37	nw.	10	14	16	1	3.9	
Middle Slope.							74.8	— 1.5									66	5.00	+ 0.1									4.0	
Denver	5,291	79	151	24.79	29.95	+ .04	68.8	— 2.9	95	15	82	47	7	55	37	55	48	59	2.13	+ 0.4	9	5,138	s.	37	w.	12	11	15	5	4.5	
Pueblo	4,685	80	86	25.32	29.91	.00	72.2	— 1.8	98	15	86	50	7	58	40	58	52	60	2.68	+ 0.5	9	5,235	se.	38	ne.	21	15	14	2	3.8	
Concordia	1,398	42	47	28.51	29.95	.00	75.0	— 2.1	93	29	85	52	23	65	27	67	63	71	2.97	— 0.6	12	5,052	s.	36	nw.	13	12	15	4	4.8	
Dodge	2,509	44	54	27.40	29.93	.00	76.1	— 1.5	96	11	87	55	23	65	32	66	62	69	1.71	— 1.4	15	8,501	se.	45	sw.	10	16	10	5	4.0	
Wichita	1,358	78	86	28.58	29.98	+ .02	76.7	— 1.7	95	30	86	59	24	67	26	69	65	73	7.46	+ 4.2	12	5,411	se.	39	n.	9	18	10	3	3.9	
Oklahoma	1,214	79	86	28.70	29.94	— .02	80.0	+ 1.0	95	11	90	64	7	70	25	70	65	67	1.07	— 2.6	6	8,000	s.	34	sw.	3	17	12	2	3.0	
Southern Slope.							78.3	— 1.0									60	2.60	0.0									4.2	
Abilene	1,738	45	54	28.17	29.93	.00	81.6	— 1.1	100	12	92	65	24	71	24	68	62	59	2.71	+ 1.0	5	6,637	se.	42	w.	22	16	12	3	3.9	
Amarillo	3,676	10	49	26.28	29.92	.00	75.0	— 1.0	94	13	87	55	3	63	31	63	58	62	2.48	— 0.9	6	9,603	se.	52	nw.	7	14	14	3	4.4	
Southern Plateau.							78.2	— 1.8									38	1.13	— 0.2									3.0	
El Paso	3,762	10	110	26.15	29.80	— .04	81.8	— 0.1	100	11	94	64	2	70	30	61	49	40	0.59	— 1.5	6	7,346	e.	46	nw.	12	16	14	1	3.7	
Santa Fe	7,013	47	50	23.36	29.85	— .03	69.0	+ 0.5	86	10	80	53	23	58	28	52	40	43	0.66	— 2.1	14	5,111	se.	41	ne.	18	14	16	1	3.6	
Flagstaff	6,907	12	25	23.43	29.84	+ .01	63.1	— 4.6	89	11	79	35	13	48	46	48	36	46	3.61	+ 1.8	11	5,114	sw.	36	sw.	12	14	6	11	4.3	
Phoenix	1,108	50	56	28.65	29.76	— .02	88.4	— 1.8	112	11	103	69	13	74	38	64	46	31	1.89	+ 0.9	5	3,824	e.	33	e.	23	20	8	3	2.5	
Yuma	141	16	46	29.61	29.75	— .01	88.6	— 2.9	110	11	102	63	6	75	49	69	58	43	0.05	— 0.1	2	5,059	sw.	27	se.	20	28	2	1	1.0	
Independence	3,910	51	58	25.92	29.80	— .03	78.1	— 2.2	97	20	90	59	16	66	30	55	35	25	T.	— 0.1	0	6,362	nw.	32	nw.	31	20	8	3	2.7	
Middle Plateau.							71.2	— 1.6									39	0.49	+ 0.1									2.8	
Carson City	4,720	82	92	25.26	29.86	— .01	66.8	— 1.2	92	20	82	40	16	52	40	51	40	44	T.	— 0.2	0	4,985	w.	36	sw.	14	23	7	1	2.4	
Winnemucca	4,344	59	70	25.58	29.88	— .02	68.8	— 2.6	94	21	84	40	16	53	42	54	44	46	0.65	+ 0.5	7	6,156	ne.	43	sw.	14	21	8	2	2.3	
Modena	5,479	10	43	24.61	29.83	— .03	70.4	— 0.9	95	19	86	45	9	55	40	51	34	34	0.69	+ 0.2	6	9,081	sw.	51	sw.	15	16	12	3	3.6	
Salt Lake City	4,366	105	110	25.57	29.84	— .06	73.9	— 1.6	97	20	87	51	16	61	34	55	40	33	0.59	+ 0.1	4	4,850	se.	44	w.	12	23	6	2	2.5	
Grand Junction	4,608	43	51	25.36	29.86	— .03	76.3	— 1.5	98	19	91	55	2	62	38	57	44	37	0.54	0.0	4	4,534	se.	38	se.	15	17	14	0	3.4	
Northern Plateau.							70.6	— 0.5									48	0.81	+ 0.3									3.9	
Baker City	3,471	53	59	26.43	29.96	+ .01	65.2	— 0.8	93	21	78	39	29	52	36	52	43	51	0.71	+ 0.1	6	3,851	nw.	28	nw.	21	11	12	8	4.7	
Boise	2,739	61	68	27.10	29.90	— .03	72.1	— 1.0	102	21	87	44	16	57	39	56	44	44	0.49	+ 0.3	7	2,972	nw.	20	nw.	15	18	9	4	3.5	
Lewiston	757	10	51	29.11	29.90	— .05	75.0	+ 1.0	105	21	89	52	13	61	45	.....	.....	.....	1.37	+ 0.8	8	4,440	e.	50	w.	28	19	8	4	3.2	
Pocatello	4,482	46	54	25.46	29.90	— .02	68.9	— 1.4	96	22	84	44	30	54	39	52	39	41	0.49	0.0	8	5,799	e.	31	w.	12	11	20	0	3.7	
Spokane	1,929	101	110	27.92	29.92	— .04	69.8	+ 0.8	98	21	83	45	16	57	41	55	44	47	0.34	— 0.4	5	4,933	s.	32	s.	12	10	7	14	5.4	
Walla Walla	1,000	65	71	28.87	29.92	— .05	72.6	— 1.4	102	21	85	49	13	60	39	60	52	55	1.47	+ 1.2	9	4,111	s.	25	se.	6	22	7	2	2.9	
N. Pac. Coast Reg.							60.8	— 0.5									75	0.94	+ 0.1									5.0	
North Head	211	11	56	29.83	30.05	— .03	55.7	— 2.8	69	25	59	47	13	52	15	54	52	89	0.88	— 0.2	7	12,463	nw.	62	se.	16	5	8	18	6.8	
Port Crescent	259	12	29	29.76	30.04	— .02	55.8	— 0.5	82	25	63	41	19	48	33	.....	.....	.....	0.70	+ 0.2	4	3,565	w.	15	ne.	25	17	7	7	3.8	
Seattle	123	114	151	29.91	30.04	.00	64.2	+ 0.1	90	21	73	48	13	55	30	56	51	68	0.58	— 0.1	6	4,982	w.	26	s.	17	12	12	7	4.3	
Tacoma	213	113	120	29.78	30.00	— .06	63.2	+ 1.2	87	25	73	45	13	54	33	.....	.....	.....	0.94	+ 0.2	4	4,570	n.	27	sw.	15	11	13	7	5.1	
Tatoosh Island	86	7	57	29.94	30.04	— .01	53.8	— 1.7	67	25	57	46	14	50	15	52	51	91	2.43	+ 0.4	10	9,427	sw.	44	e.	25	6	9	16	6.6	
Portland, Oreg	154	68	96	29.84	30.00	— .05	67.0	+ 0.7	100	25	78	43	13	57	38	58	52	64	0.73	+ 0.2	5	4,656	nw.	20	nw.	30	11	13	7	4.8	
Roseburg	518	56	60	29.46	30.02	— .01	66.0	— 0.3	98	20	79	42	13	53	42	56	50	64	0.31	— 0.2	4	3,221	n.	20	n.	29	18	10	3	3.4	
Mid. Pac. Coast Reg.							63.6	— 0.9									64	0.18	+ 0.1									4.0	
Eureka	62	62	80	29.97	30.04	— .01	54.9	— 0.9	62	19	58	47	14	52	13	52	50	86	0.75	+ 0.7	5	5,028	nw.	36	n.	29	3	10	18	7.0	
Mount Tamalpais	2,375	11	18	27.51	29.94	— .01	66.8	.....	88	20	74	44	9	60	21	53	41	46	0.08	.....	2	11,115	nw.	59	nw.	28	23	8	0	1.7	
Red Bluff	332	50	56	29.49	29.83	— .06	80.6	— 1.2	107	24	95	56	9	66	35	62	49	40	0.11	+ 0.1	2	3,625	se.	26	nw.	29	25	5	1	1.3	
Sacramento	69	106	117	29.79	29.86	— .02	71.2	— 1.4	99	19	85	53	12	58	38	50	53	59	T.	0.0	0	7,287	s.	32	sw.	14	27	3	1	1.0	
San Francisco	155	161	167	29.81	29.98	+ .03	57.1	— 1.2	73	29	62	50	26	52	20	53	51	87	0.02	0.0	1	10,574	w.	38	w.	24	20	6	5	3.7	
Point Reyes Light	490	7	50	.....	.....	.....	54.0	+ 0.2	66	29	58	48	6	50	17	.....	.....	.....	0.00	— 0.3	0	17,776	nw.	66	nw.	16	6	9	16	7.0	
Southeast Farallon	30	9	17	29.94	29.97	.....	54.4	.....	62	31	56	50	5	52	8	.....	.....	.....	0.00	.....	0	11,974	nw.	40	nw.	28	8	9	14	6.3	
S. Pac. Coast Reg.							69.8	— 0.9									67	T.	0.0									2.3	
Fresno	330	67	70	29.49	29.84	+ .01	79.8	— 1.7	109	25	96	54	10	63	40	59	41	34	0.00	0.0	0	5,562	nw.	24	nw.	7	39	1	0	0.6	
Los Angeles	338	116	123	29.55	29.91	+ .01	69.5	+ 0.2	86	27	80	54	13	59	30	61	57	76	T.	0.0	0	4,109	w.	24	sw.	11	19	12	0	3.4	
San Diego	87	94	102	29.81	29.90	— .02	66.7	— 0.4	76	10	71	59	13	62	15	62	59	80	0.00	0.0	0	4,335	nw.	23	nw.	10	24	6	1	2.7	
San Luis Obispo	201	47	54	29.73	29.94	— .01	63.2	— 1.5	89	24	75	46	10	51	37	55	52	77	T.	0.0	0	3,620	nw.	20	w.	15	26	4	1	2.4	
West Indies.																													
Basseterre	29	41	54	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
Bridgetown	30	57	65	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
Cienfuegos	52	62	67	29.97	30.02	+ .03	79.5	.....	92	10	89	66	10	70	26	73	70	79	6.81	.....	16	5,013	ne.	20	se.	3	10	19	2	4.3	
Grand Turk	11	6	20	30.05	30.06	+ .04	81.8	.....	90	*	87	71	*	76	16	.....	.....	.....	1.43	.....	11	.....	e.	.....	.....	.....	9	13	9	5.5	
Hamilton	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
Havana	57	87	105	29.98	30.04	+ .04	79.8	— 2.6	89	14	87	66	24	73	22	.....	.....	.....	3.68	— 1.4	12	7,703	e.	44	se.	24	17	13	1	2.8	
Puerto Principe	352	55	62	29.69	30.05	+ .05	79.0	.....	94	23	88	65	27	70	23	73	71	84	3.56	.....	16	6,751	e.	32	se.	27	9	17	5	5.0	
San Juan	82	48	90	29.96	30.04	+ .05	79.5	— 1.8	88	17	85	71	31	74	15	74	72	77	4.70	— 1.0	18	10,452	e.	34	se.	2	7	14	10	5.9	

* More than one date.

TABLE II.—*Climatological record of voluntary and other cooperating observers, July, 1904.*

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Alabama.	°	°	°	*Ins.*	*Ins.*
Anniston	95	56	76.4	4.12	
Ashville	93	55	76.4	4.14	
Benton				4.88	
Bermuda	97	60	79.0	5.51	
Boligee	100	58	79.6	5.99	
Bridgeport				4.40	
Burkeville				3.05	
Calera				4.22	
Camphill	96			7.23	
Cedar Bluff				3.49	
Citronelle	95	64	78.7	4.99	
Clanton	98	57	78.0	6.15	
Cordova	97	56	77.7	4.87	
Daphne	91	66	79.3	4.97	
Decatur	94	62	78.2	5.39	
Delmar	95	56	77.3	1.80	
Demopolis				3.48	
Eufaula	95	62	79.7	2.87	
Evergreen	97	60	79.0	3.40	
Florence *a*				5.85	
Florence *b*	95	56	77.2	6.33	
Fort Deposit	97	60	80.3	7.83	
Gadsden	99	60	79.2	4.05	
Goodwater	96	59	77.7	4.80	
Greensboro	98	62	79.1	6.93	
Greenville				3.17	
Hamilton	97°	54°	76.8°	2.42	
Highland Home	93	58	76.6	5.75	
Letohatchie				5.31	
Livingston	100	60	78.7	6.52	
Lock No. 4	96	58	77.4	3.95	
Madison Station	100	58	77.6	4.87	
Maplegrove	100	58	77.6	4.29	
Marion	101	65	82.0	6.83	
Milstead				7.68	
Newbern	103	57	80.6	5.61	
Notasulga				6.13	
Oneonto	94	55	76.3	6.49	
Opelika	100	62	79.4	5.48	
Ozark	95	63	79.2	4.20	
Prattville	97	57	78.0	9.17	
Pushmataha	97	58	78.2	5.27	
Riverton	96	54	76.8	4.22	
Scottsboro	94	57	76.5	5.87	
Selma	101	61	81.5	3.95	
Spring Hill	96	66	81.2		
Talladega	100	59	78.9	3.20	
Tallassee				3.46	
Thomasville	99	59	80.1	3.41	
Tuscaloosa	101	59	79.5	2.76	
Tuscumbia	96	60	78.5	3.49	
Tuskegee	99	62	80.4	3.24	
Union Springs	96	64	80.6	2.05	
Uniontown	98	58	77.6	4.78	
Valleyhead	95	55	75.2	5.76	
Verbena				3.52	
Wetumpka	98	59	80.0	7.72	
Alaska.					
Juneau	69	41	53.2	8.15	
Petersburg	70°	35	52.2°	9.20	
Sitka	62	34	50.6	5.95	
Skagway	77	39	56.4	1.07	
Tanana	76	30	52.4	0.78	
Arizona.					
Agua Caliente	113[b]	62[b]	91.3[b]	0.04	
Allaire Ranch				2.09	
Arizona Canal Co. Dam				2.85	
Aztec	116	64	90.4	0.00	
Benson	105	60	81.2	1.63	
Bisbee	95	59	75.5	2.59	
Blue	104	44	71.5	2.00	
Bowie	106	52	77.2	1.19	
Buckeye	108[f]	54[f]	83.1[f]	3.00	
Casagrande	117	63	90.8	1.96	
Cochise *1	106	58	78.8	3.00	
Congress	103	62	83.3	1.80	
Douglas	106	55	80.2	3.08	
Dragoon *1	101	74	81.4	1.60	
Dudleyville	109	57	84.8	3.70	
Fort Apache	99	44	72.3	0.48	
Fort Defiance	90	41	65.2	2.51	
Fort Grant	103	59	83.9	1.35	
Fort Huachuca	99	58	77.2	5.70	
Fort Mohave	114	64	90.2	0.05	
Gilabend	114			0.80	
Grand Canyon	95	46	70.7	6.00	
Greaterville	95	55	74.6	2.65	
Greer				3.87	
Holbrook	100	44	74.4	0.16	
Jerome	99	60	79.3	2.30	
Kingman	102	53	79.4	0.79	
Maricopa	113	62	88.3	1.00	
Mesa	112	60	87.6	1.60	
Mesa (near)	115	59	87.2	1.72	
Mohawk Summit *1	118	80	96.9	0.10	
Natural Bridge				5.67	
Oracle	99	62	81.0	2.35	
Oro				0.70	

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Arizona—Cont'd.	°	°	°	*Ins.*	*Ins.*
Parker	115	60	90.2	1.20	
Phoenix	113	61	87.4	1.61	
Pinal Ranch				2.46	
Prescott	100	50	75.9	4.57	
Reef				5.85	
St. Johns				2.15	
San Carlos	111	54	84.4	1.31	
San Simon	105	54	82.2	1.29	
Sentinel *1	115	80	93.8	0.00	
Signal	114	50	86.2	1.38	
Superstition				2.10	
Taylor	97	40	71.0	0.90	
Thatcher	108	49	81.6	2.61	
Tombstone	100	60	78.2	3.50	
Tonto		61		2.95	
Tuba	95			0.96	
Tucson	107	55	84.9	1.75	
Upper San Pedro	103	50	77.6	2.19	
Vail *1	101	74	82.7	0.15	
Walnutgrove				4.20	
Wilcox	104	52	77.6	1.62	
Williams	95	40	67.8	3.54	
Yarnell				3.59	
Young	105	41	77.1	2.12	
Arkansas.					
Alco	94	54	76.6	2.85	
Amity	91	61	76.6	3.79	
Arkadelphia	95	63	79.0	4.28	
Arkansas City				6.18	
Batesville	92	58	77.0	3.58	
Beebranch	95	57	76.5	2.37	
Blanchard Springs	95	61	78.7	4.52	
Brinkley	95	59	78.4	5.16	
Camden *a*				5.77	
Camden *b*	97	67	80.4	5.44	
Conway	100	61	79.5	3.20	
Corning	91	55	75.9	2.79	
Dallas	94	58	78.8	4.36	
Dardanelle				2.86	
De Queen	94	61	79.4	5.80	
Des Arc	95	60	78.6	5.99	
Dodd City	100	51	76.8	5.30	
Dutton	87	52	71.5	6.34	
Elon	95°	61°	79.1°	9.06	
Eureka Springs	93	52	74.8	4.57	
Fayetteville	91	51	75.8	8.07	
Forrest City	94	58	77.6	4.23	
Fulton				7.02	
Hardy	96	57	77.1	3.45	
Heber	97	55	77.8	3.84	
Helena *a*				5.02	
Helena *b*	96	60	78.9	5.24	
Hope	98	63	79.9	5.61	
Howe	97	62	80.8	4.62	
Jonesboro	104	57	80.4	3.62	
Lacrosse	96	56	76.5	2.18	
Lake Village	94	61	79.0	2.23	
Lonoke	99	59	80.1	3.61	
Lutherville	96	56	76.2	5.34	
Malvern	96	58	78.6	3.95	
Mammoth Springs	94	61	78.4	1.50	
Marvell	96	60	79.1	4.98	
Mossville	87	54	72.0	4.79	
Mount Nebo	89	62	76.2	4.89	
New Gascony	96	61	79.4	4.60	
New Lewisville	96	63	79.7	8.26	
Newport *a*				1.37	
Newport *b*	99	58	79.6	1.06	
Oregon	95	49	72.8	4.06	
Osceola	96	59	78.2	1.20	
Ozark	94°	61°	78.6°	3.01	
Perry	100	60	79.8	3.86	
Pinebluff	101	61	80.1	2.36	
Pocahontas	96	56	77.4	4.51	
Pond	91	50	74.6	6.84	
Prescott	95[d]	64[d]	80.0[d]	2.99	
Princeton	95	59	78.1	3.53	
Rison	96	57	76.9	3.80	
Russellville	98	60	79.0	3.60	
Silversprings	89	53	73.6	8.06	
Spielerville	96	63	79.0	4.01	
Stuttgart	95	59	78.5	6.32	
Texarkana	94	61	79.8	4.86	
Warren	97	61	80.0	8.20	
Wiggs	93	55	76.9	8.58	
Winchester	95	60	79.4	3.24	
Witts Springs	90°	50°	72.8°	2.15	
California.					
Alturas				0.55	
Angiola	110	47	77.0	0.00	
Azusa	97	48	73.0	0.00	
Bagdad	110	71	93.2	0.90	
Bakersfield	109	53	79.2	0.00	
Barstow	109	53	82.2	0.40	
Bear Valley				0.12	
Berkeley	79	49	59.6	0.00	
Bishop	97	47	72.8	0.39	
Boca *1	91	40	66.0	0.55	

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
California—Cont'd.	°	°	°	*Ins.*	*Ins.*
Bodie	86	23	55.4	2.83	
Bowman				0.20	
Branscomb	93	39	63.6	0.86	
Brush Creek	106	42	73.1	0.01	
Butte Valley				0.70	
Caliente *1	103	68	83.6	0.00	
Campbell	90	40	64.6	0.00	
Campo				0.85	
Cedarville	99	42	67.4	0.62	
Chico	106	53	80.2	0.00	
Chino *5	100	58	78.8	0.00	
Cisco *1	76	50	62.5	0.00	
Claremont	100	46	73.3	0.00	
Cloverdale	106	43	70.6	0.04	
Colusa	100	54	75.2	0.00	
Corning *5	102	66	79.4	0.00	
Coronado	78	58	66.8	0.00	
Craftonville				T.	
Crescent City	76	41	56.2	1.94	
Cuyamaca	85	40	64.2	0.20	
Delano *1	109	62	85.8	0.00	
Delta	105	48	77.9	0.00	
Dobbins	105	54	79.4	0.00	
Dunnigan *1	102	60	80.8	0.00	
Durham	102	51	77.5	0.00	
Elcajon	99	48	72.0	0.00	
Electra				0.00	
Elmdale	110	45	77.1	0.00	
Elsinore	104	48	76.0	0.00	
Escondido	96	40	68.4	0.00	
Folsom				T.	
Fordyce				0.50	
Fort Ross	72	43	57.6	0.16	
Foster				0.00	
Georgetown	100	46	72.6	0.00	
Gilroy (near)	100	43	66.0	0.00	
Greenville	104	34	66.2	0.23	
Hanford	108	51	78.8	0.00	
Healdsburg	100°	42°	68.8°	T.	
Hollister	100	41	65.2	T.	
Idylwild	89	40	65.6	T.	
Imperial	112	60	89.3	0.45	
Indio	116	72	96.6	T.	
Iowa Hill *1	92	57	71.9	0.00	
Irvine				T.	
Isabella	106	51	80.4	0.00	
Jamestown	101	44	72.4	0.00	
Kennedy Gold Mine				0.00	
Kentfield				T.	
King City	102	40	67.4	T.	
Laguna Valley				1.67	
Laporte	85	35	62.8	0.10	
Legrande	109	44	75.0	0.00	
Lemoncove	108[d]	52	79.5	0.00	
Lick Observatory	86	46	66.0	T.	
Livermore	103	44	69.4	T.	
Lodi	100	47	71.2	0.00	
Los Gatos	96	45	67.2	0.00	
Magalia	104	50	74.6	0.00	
Mammoth	114	64	91.2	0.00	
Marysville	104	52	75.0	0.00	
Merced	110	40	76.1	0.00	
Mercury				0.05	
Mills College				T.	
Milo				0.00	
Milton (near)	102	52	75.0	0.00	
Modesto *1	106	63	75.8	0.00	
Mohave	105	62	83.3	0.00	
Mokelumne Hill				0.00	
Montague	106	40	71.0	0.39	
Monterio	96	50	73.1	0.00	
Monterey *1	69	49	59.0	0.00	
Mount St. Helena				0.22	
Napa	93	47	65.4	T.	
Needles	111	72	94.2	0.00	
Nellie				T.	
Nevada City	97	40	67.6	0.00	
Newcastle	104	42	82.0	0.00	
Newman	108	50	78.4	0.00	
Niles	90	46	66.0	0.00	
Nordhoff				T.	
North Bloomfield	99	41	71.3	T.	
Oakland	82	50	63.0	T.	
Ontario (near)	101	49	74.6	0.00	
Orland	109	54	80.2	T.	
Orleans	110	49	76.4	0.61	
Oroville (near)	107	51	77.0	0.00	
Palermo	106	50	76.2	T.	
Peachland *5	85	51	65.0	0.05	
Pilot Creek				T.	
Pine Crest	90	49	66.4	0.00	
Pino Grande	92	42	65.6	0.07	
Placerville	97	44	68.8	0.00	
Point Lobos	72	53	60.1	0.02	
Porterville	107	54	79.8	0.00	
Poway				T.	
Quincy	91	36	65.6	0.05	
Redding	103	58	79.6	0.59	

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
California—Cont'd.	°	°	°	*Ins.*	*Ins.*
Redlands	104	50	75.0	0.00	
Reedley	111	61	85.6	0.00	
Represa	94	60	76.9	0.00	
Riovista	99	50	71.9	T.	
Riverside	103	48	75.4	0.07	
Rohnerville				0.48	
Rosewood	106	53	78.6	0.10	
Sacramento	94	51	69.8	T.	
Salinas	80	44	61.4	0.00	
Salton	116	58	92.4	1.00	
San Bernardino	103	44	74.3	0.00	
San Jacinto	86	49	67.6	0.00	
San Jose	93	47	66.5	0.00	
San Leandro	84	48	62.0	0.07	
San Mateo*1	87	59	67.9	0.00	
San Miguel*1	104	55	71.3	0.00	
San Rafael	93	45	65.0	0.00	
Santa Barbara	83	49	64.8	0.00	
Santa Clara College	94	42	65.0	0.00	
Santa Cruz	88	41	61.3	0.00	
Santa Maria	83	44	63.2	0.00	
Santa Monica	78	50	65.5	0.00	
Santa Rosa	92	42	64.2	T.	
Shasta	110	55	81.6	0.04	
Sierra Madre	92	47	71.0	0.00	
Sisson	107	36	69.9	0.07	
Snedden				0.00	
Sonoma				0.05	
Sonora	99	63	80.6	T.	
Stockton	98	51	71.3	0.00	
Storey	108	49	76.6	0.00	
Summerdale	86	42	65.2	0.00	
Summit	76	55	66.1	0.04	
Susanville	91	37	67.2	0.05	
Tehama*1	104	66	82.9	0.00	
Tejon Ranch	101	54	79.0	0.00	
Truckee*1	88	30	51.6	0.00	
Tulare c	106	50	78.0	0.00	
Tustin				0.00	
Ukiah	106	45	71.9	0.10	
Upland	93	50	71.2	T.	
Upperlake	104	44	71.6	0.07	
Upper Mattole				0.70	
Vacaville*1	104	56	73.0	0.00	
Ventura	77	50	63.1	0.00	
Visalia	108	52	77.8	0.00	
Volcano	117	63	91.2	0.90	
Wasco	108	55	80.6	0.00	
Wheatland	103	51	75.0	0.00	
Willits	99	40	68.2	0.43	
Willow	104	53	77.5	T.	
Yosemite				0.00	
Zenia	91	40	61.7	1.05	
Colorado.					
Alford	83	33	59.2	3.56	
Antelope Springs	83	24	53.4		
Ashcroft	78	31	54.2	1.28	
Blaine	100	55	74.6	4.15	
Boulder	90	41	67.8	1.05	
Boxelder				4.42	
Breckenridge	77	31	53.0	1.03	
Buenavista				0.10	
Burlington	97	44	70.4	3.78	
Canyon	96	43	70.4	1.21	
Castlerock	90	40	65.4	3.60	
Cheesman	89	41	64.6	2.12	
Cheyenne Wells	96	51	72.2	3.39	
Clearview	74	33	52.6	1.97	
Collbran	94	38	67.4	1.19	
Colorado Springs	89	43	65.0	3.10	
Conejos	87	39	63.0	1.16	
Cripplecreek				4.57	
Delta	99	36	71.2	0.08	
Durango	93	38	66.2	0.78	
Eagle	88	34	59.8	1.03	
Fort Collins	91	40	65.6	1.99	
Fort Morgan	94			2.70	
Fowler				2.00	
Fox	97	49	70.2	2.07	
Fruita	99	46	71.8	0.27	
Garnett	87	32	60.6	0.96	
Gilman				1.53	
Gleneyre	88	39	63.6	3.10	
Glenwood	92	36	63.6	0.99	
Greeley	94	42	69.2	3.77	
Grover				3.30	
Gunnison	89	31	58.9	1.34	
Halls Gulch	67	29	46.1	1.39	
Hamps	89	44	64.8	2.69	
Hoehne	93	40	69.6	1.20	
Holly	99	52	74.7	3.82	
Holyoke (near)	99	45	70.8	2.79	
Husted	87	37	62.3	2.27	
Lake Moraine	71	32	52.3	3.54	
Lamar	102	53	76.2	3.95	
Laporte				1.86	
Las Animas	101	48	73.0	3.48	
Lay	92	32	63.0	0.65	
Leadville (near)	75	34	53.4	0.51	
Leroy	95	46	68.2	3.46	
Longs Peak	76	28	51.6	1.96	
Mancos	90	39	65.2	0.63	
Marshall Pass				0.71	
Meeker	90	34	61.6	0.43	
Montrose	91	40	64.8	0.66	
Moraine	80	32	57.8	0.90	
Pagoda	89	32	62.0	0.50	
Parachute	97	44	70.8	1.63	
Platte Canon				2.65	
Rockyford	99	49	72.8	1.75	
Ruby				1.00	
Saguache	86	38	62.6	1.18	
Salida	87	36	62.4	1.57	
San Luis	83	36	61.8	2.06	
Santa Clara	87	40	62.2	2.75	
Sheridan Lake	98k	52k	74.4k	7.28	
Silt	92	43	68.6	0.99	
Silverton	79	27	53.5	1.60	
Sugar City				1.35	
Sugar Loaf	86	35	61.0	1.85	
Trinidad	91	48	70.1	1.55	
Victor	83	40	59.8	3.86	
Vilas				2.58	
Wagon Wheel	80	23	44.0	1.32	
Walden	81	29	55.0	1.01	
Wallet				3.52	
Waterdale	90	39	65.2	3.17	
Westcliffe	85	33	61.0	3.35	
Whitepine	80	30	52.2	2.11	
Wray	96	51	72.0	2.00	
Yuma				1.65	
Connecticut.					
Bridgeport	95	50	72.0	2.53	
Canton	88	41	67.0	3.55	
Colchester	90	46	68.8	2.44	
Falls Village				6.04	
Hartford b	92	52	70.6	3.36	
Hawleyville	92	46	69.4	3.63	
Lake Konomoc				2.03	
New London	86	60	73.9	1.69	
North Grosvenor Dale	98	44	70.7	2.22	
Norwalk	97	47	71.1	2.82	
Southington	89	46	69.4	4.85	
South Manchester				2.30	
Storrs	89	46	68.7	1.85	
Voluntown	91	43	69.2	1.90	
Wallingford				2.31	
Waterbury	95	43	71.5	4.62	
West Cornwall	90	47	67.4	6.15	
West Simsbury				3.47	
Delaware.					
Delaware City				4.09	
Milford	98	53	75.6	7.02	
Millsboro	97	52	74.7	7.20	
Newark	93	51	73.2	3.81	
Seaford	94	54	73.5	7.74	
District of Columbia.					
Distributing Reservoir*5	92	58	75.1	6.96	
Receiving Reservoir*5	87	63	75.0	7.26	
West Washington	96	54	75.4	7.67	
Florida.					
Apalachicola	92	70	80.8	1.62	
Archer	96	66	79.6	6.55	
Avon Park	97	66	80.7	7.56	
Bartow	96	66	81.3	8.77	
Bonifay	95	61	79.6	4.87	
Brooksville	95	66	79.3	10.59	
Carrabelle	96	61	80.4	4.36	
Clearmont	99	67	82.8	3.30	
De Funiak Springs	94	60	78.4	3.21	
Deland	95	65	79.9		
Eustis	96	66	81.8	6.07	
Federal Point	96	65	79.8	3.75	
Fernandino	96	68	80.8	2.13	
Fort Meade	95	65	80.0	9.69	
Fort Pierce	93	64	79.6	3.27	
Gainesville	96	63	80.1	7.33	
Grasmere	97	62	81.8		
Huntington	99	62	79.0	6.65	
Hypoluxo	89	67	79.8	4.30	
Inverness		65		2.02	
Jasper	95	67	79.8	8.95	
Kissimmee	94	66	80.6	8.56	
Lake City	95	64	80.1	10.43	
Macclenny	99	61	80.6	9.09	
Madison	94	67	79.6	3.17	
Malabar	95	66	81.0	3.08	
Manatee	92	66	79.5	9.91	
Marco	94	68	82.4	5.34	
Marianna	98	59	79.3	6.64	
Merritt Island	92	68	80.9	1.88	
Miami	91	70	81.2	2.94	
Micanopy	98e	64e	80.8e		
Middleburg	99	62	79.9	6.59	
Molino	95	58	58.0	9.09	
Monticello	95	65	79.4	6.85	
Myers	89	67	79.0	5.60	
New Smyrna	96	63	79.3	3.48	
Nocatee	96	66	80.8	8.56	
Ocala	97	66	80.5	8.79	
Orange City	101	65	81.9	6.98	
Orange Home	94	67	80.3	6.56	
Pinemount	98e	67e	80.8e	7.11	
Plant City	98	65	80.4	4.50	
Rockwell	96	67	81.2	11.93	
St. Andrews	92	63	79.3	7.95	
St. Augustine	97	66	80.2	3.14	
St. Leo	93	66	79.3	7.99	
Stephensville	96	57	79.8	6.80	
Sumner	93	64	78.9	14.84	
Switzerland	97	63	80.0	3.35	
Tallahassee	95	66	80.6	3.95	
Tarpon Springs	93	65	79.0	4.80	
Titusville	99	64	80.8	6.22	
Wausau	97	61	79.3	9.72	
Wewahitchka	97	63	79.6	8.16	
Georgia.					
Abbeville				5.31	
Adairsville	93	60	76.7	5.57	
Albany	99	64	82.9	5.73	
Allapaha	96	63	79.5	6.39	
Americus	98	63	80.6	3.39	
Athens	97	58	77.5	2.55	
Bainbridge	97	61	80.4	2.67	
Blakely	100	61e	81.2	6.09	
Bowersville	101	56	78.5	3.16	
Butler				1.10	
Camak	100	59	80.6	2.77	
Carrollton	100	60	77.0	2.75	
Canton				3.43	
Carlton				3.70	
Clayton	92	49	72.9	3.49	
Columbus	100	65	81.4	3.25	
Covington	98	61	78.7	3.47	
Cordele	98	63	80.2	5.11	
Dahlonega	92	54	73.6	2.32	
Dawson	98	61	79.8	7.28	
Diamond	92			6.98	
Dublin				3.32	
Dudley	101	62	81.0	2.97	
Eastman	100f	65	81.0e	4.67	
Eatonton	100e	62e	80.7e	1.48	
Elberton	97	58	78.4	5.70	
Experiment	96	61	78.4	3.64	
Fitzgerald	100	61	79.0	8.02	
Fleming	104	64	81.4	5.68	
Forsyth	98	60	79.6	5.08	
Fort Gaines	94	64	79.9	2.02	
Gainesville	98	60	77.2	1.60	
Gillsville	99e	56e	77.0e	2.35	
Greenbush	97	58	75.8	5.34	
Greensboro	100	57	80.2	2.83	
Griffin	98	61	79.1	2.70	
Harrison	99	62	80.1	1.75	
Hawkinsville	101	62	80.6	3.53	
Jesup	102	62d	82.0	2.32	
Lost Mountain	96	59	77.0	2.98	
Louisville	99	61	80.1	2.62	
Lumpkin	100	63	80.6	4.26	
Mauzy	96k	60k	79.1k		
Milledgevilie	101	63	81.1	2.81	
Millen	100	62	81.3	3.41	
Monticello	101	61	80.6	2.34	
Morgan	96	61	79.1	3.73	
Newnan	99	60	78.9	1.30	
Oakdale				2.66	
Point Peter	100	56	78.5	4.56	
Poulan	97	59	78.6	3.34	
Putnam	101	60	80.8	2.88	
Quitman	96	65	80.2	6.31	
Ramsey	92e	57	75.6e	3.63	
Resaca				2.78	
Rome	97	60	78.2	4.05	
St. Marys	103	63	80.8	2.04	
Statesboro	102	62	81.8	7.21	
Talbotton	100	60	79.6	4.05	
Tallapoosa	96	56	76.0	1.69	
Thomasville	94	62	79.8	4.66	
Toccoa	95	58	75.8	3.22	
Vidalia	102	63	81.8	6.75	
Valona	97	64	79.9	5.07	
Washington	99	60	79.4	2.27	
Waverly	99	62	80.7	3.12	
Waycross	99	64	80.9	5.29	
Waynesboro	99	62	80.0	4.32	
Westpoint	102	61	80.6	2.47	
Woodbury	99	58	77.8	2.28	
Idaho.					
Albion	94e	36e	65.8e	0.16	
American Falls	99	37	67.4	0.47	
Blue Lakes	99	46	72.4	0.44	
Burnside	98	35	68.7	0.14	
Cambridge	104	39	71.8	0.84	
Chesterfield	93	26	60.5	0.87	

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Idaho—Cont'd.	°	°	°	*Ins.*	*Ins.*
Dewey	91	29	61.4	1.20	
Forney				0.86	
Garnet	109	47	79.3	0.02	
Grangeville	95	43	64.5	2.73	
Hailey	99	30	64.2	2.07	
Idaho City	98	34	66.2	0.48	
Lake	82	32	57.3	0.50	
Landore				1.67	
Lost River	90	37	64.2	0.65	
Lovell	89	35	60.7	1.30	
Meadows	94	32	64.0	0.85	
Milner	102	40	71.2	0.22	
Moscow	94	40	65.7	1.30	
Murray	93	36	63.8	3.06	
Oakley	98	36	65.8	0.71	
Ola	101	38	70.4	0.96	
Orofino	102	42	69.3	1.26	
Payette	105	40	72.4	0.69	
Pollock	101	47	71.4	1.12	
Poplar				0.37	
Porthill	90	42	66.0	0.86	
Priest River	97	36	64.8	1.26	
Riddle	89	39	61.0	0.40	
Roosevelt	80	29	55.6	3.28	
St. Maries	99	41	67.6	1.13	
Soldier	94	28	62.6	0.18	
Vernon	94	32	63.6	T.	
Weston	94	34	66.1	0.97	
Illinois.					
Albion	94	51	75.2	1.80	
Aledo	91	47	71.6	4.49	
Alexander	92	48	73.0	3.74	
Antioch	96	42	70.4	4.41	
Ashton	92	43	70.2	4.35	
Astoria	91	44	71.4	5.42	
Aurora	94	43	70.8	3.81	
Beardstown				1.34	
Benton	95[a]	56[a]	77.0[a]	5.20	
Bloomington	95	44	74.2	3.89	
Bushnell	95	52	73.6	7.27	
Cambridge	93	50	73.2	10.39	
Carlinville	90	49	73.2	9.51	
Carrollton	92	50	73.7	7.08	
Charleston	94	46	74.2	3.67	
Chester				3.57	
Cisne	94	52	73.2	4.90	
Coatsburg	93	50	73.1	3.93	
Cobden	95	57	76.0	2.83	
Danville	94[a]	45[a]	72.4[a]	3.55	
Decatur	94	45	73.7	4.44	
Dixon	95	43	70.7	7.58	
Equality	96	55	76.4	3.69	
Fandon	93	47	72.2	5.75	
Flora	90	52	73.2	3.41	
Friendgrove	91	55	74.6	4.61	
Galva	93	47	71.8	8.83	
Grafton				5.34	
Greenville	94	52	74.9	5.12	
Griggsville	94	51	74.0	5.09	
Halfway	91	57	75.6	4.82	
Hallidayboro				4.50	
Havana	97	43	74.8	4.50	
Henry	92	47	72.0	5.73	
Hillsboro	95	50	74.4	5.38	
Hoopeston	94	44	72.8	4.36	
Joliet	94	45	72.2	2.97	
Kishwaukee	93	44	71.4	3.15	
Knoxville	91	42	70.2	7.87	
Lagrange	99	44	72.8	3.55	
Laharpe	95	50	72.4	6.45	
Lanark	98	35	71.9	2.94	
Loami				4.01	
McLeansboro	94	57	75.4	5.48	
Martinsville	93	46	73.6	3.20	
Martinton	96	42	72.2	2.03	
Mascoutah	91	53	72.8	5.05	
Mattoon	91	51	75.4	6.76	
Minonk	93	42	71.4	6.23	
Monmouth	95	45	71.8	8.66	
Morrison	92	41	70.3	4.04	
Morrisonville	93	50	73.3	6.78	
Mount Carmel				4.46	
Mount Pulaski	94	47	73.4	2.22	
Mount Vernon	94	55	75.8	5.66	
New Burnside	95	54	76.4	5.24	
Olney	94	51	75.7	2.27	
Ottawa	93	46	72.1	5.14	
Palestine	97	51	75.2	3.81	
Pana	92	51	74.0	6.39	
Paris	93	54	74.4	1.57	
Peoria[a]				5.93	
Peoria[b]	104	48	76.0	5.58	
Philo	93	41	72.0	2.17	
Plumhill	90	53	73.3	5.14	
Pontiac	92	47	72.6	5.37	
Rantoul	94	42	72.6	6.60	
Raum	95	55	75.6	3.82	
Riley	93	46	70.6	3.35	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Illinois—Cont'd.	°	°	°	*Ins.*	*Ins.*
Robinson	91	48	73.8	4.85	
Rushville	92	46	73.1	4.39	
St. Charles	95	46	71.0	5.82	
St. John	95	55	75.3	6.66	
Shobonier				3.48	
Streator	93	45	71.9	4.60	
Sullivan	92	45	73.4	2.91	
Sycamore	96	46	71.5	4.04	
Tilden	92	54	74.1	2.23	
Tiskilwa	90	51	70.8	6.78	
Tuscola	93	44	72.6	2.07	
Urbana	92	41	72.6	2.72	
Walnut	94	44	72.7	5.34	
Winchester	91	51	73.4	4.15	
Windsor	91	43	72.4	4.10	
Winnebago	93	44	70.6	3.41	
Yorkville	99	44	71.8	3.88	
Zion	94	41	70.2	2.73	
Indiana.					
Anderson	92	45	71.7	2.42	
Angola	93	45	70.6	3.15	
Auburn	93	45	70.8	1.72	
Bloomington	92	51	74.2	2.20	
Bluffton	92	42	70.6	4.98	
Butlerville	96	46	73.9	0.93	
Cambridge City	92	45	70.8	2.64	
Columbus	96	46	73.5	1.25	
Connersville	92	45	71.8	2.34	
Crawfordsville	98	46	73.8	4.97	
Delphi	95	43	71.8	5.54	
Elkhart	96	49	72.8	2.35	
Farmersburg	92	48	72.8	2.76	
Farmland	90	46	70.4	2.63	
Fort Wayne	100	38	71.0	4.84	
Greencastle	90	48	72.4	3.04	
Greenfield		46	73.0[f]	3.29	
Greensburg	96	43	73.6	2.86	
Hammond	95	45	71.8	3.07	
Hector	100	47	75.0	3.44	
Holland	95	52	75.4	2.39	
Huntington	91	49	71.6	5.93	
Jeffersonville	95	55	76.6	1.46	
Lafayette	92	46	72.3	6.12	
Laporte	96	47	70.5	0.94	
Logansport	95	46	72.6	4.70	
Madison[a]	98	50	76.2	0.66	
Madison[b]				0.85	
Marengo	96	50	74.0	1.51	
Marion	94	43	72.1	3.67	
Markle	91	44	70.4	3.70	
Mauzy	93	42	72.0	2.72	
Moores Hill	96	46	74.0	1.16	
Mount Vernon	96	56	76.6	4.36	
Northfield	93	43	70.1	3.60	
Paoli	96	48	73.9	3.71	
Princeton	94	51	74.9	1.70	
Rensselaer	91	45	71.6	3.28	
Richmond	91	44	70.2	1.74	
Rochester	91[e]	44	71.2[e]	4.89	
Rockville	91	46	73.3	1.92	
Rome	98[g]	54	75.9[g]	2.35	
Salem	97	49	74.7	2.85	
Scottsburg	96	53	75.9	1.89	
Seymour	93	48	73.4	1.35	
South Bend	94	47	71.4	2.38	
Syracuse	96	44	72.2	2.13	
Terre Haute	95	50	75.7	2.75	
Topeka	92	45	69.4	2.15	
Valparaiso	95	47	71.8	1.86	
Veedersburg	94[g]	42[g]	72.3[g]	3.84	
Vevay	94	53	76.4	2.10	
Vincennes	97	52	76.3	2.16	
Washington	92	50	73.2	2.39	
Winamac	98	41	72.0	1.80	
Worthington	94	48	74.6	3.64	
Indian Territory.					
Ardmore	102	55	82.3	0.95	
Chickasha	100	56	80.8	1.18	
Claremore	100	58	79.4	7.06	
Durant	102	60	80.8	4.02	
Fairland	93	53	76.4	7.12	
Goodwater	97	60	80.0	2.68	
Healdton	99	55	79.8	5.23	
Holdenville	97	62	80.1	2.94	
Marlow	98	59	79.2	1.28	
Muskogee	93	59	77.8	3.90	
Pauls Valley	101	53	80.1	1.17	
Ravia	100	60	80.8	0.62	
Roff	95			1.30	
South McAlester	96	62	80.4	1.83	
Tahlequah	99	64	81.9	4.70	
Tulsa				6.17	
Vinita	95	54	77.7	6.54	
Wagoner	95	57	78.0	6.59	
Webbers Falls	95	58	78.1	5.33	
Iowa.					
Afton	94	49	72.6	4.22	
Albia	92	50	70.2	4.65	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Iowa—Cont'd.	°	°	°	*Ins.*	*Ins.*
Algona	90	47	69.4	3.75	
Allerton	91	51	71.1	4.77	
Alta	92	49	69.4	3.12	
Amana	93	44	70.8	6.64	
Ames	94	44	70.2	2.39	
Atlantic	93	45	70.5	5.47	
Audubon	93	44	69.8	4.98	
Baxter	92	45	70.4	6.70	
Bedford	89	48	70.4	5.36	
Belknap	90	54	71.9	4.28	
Belleplaine	93	47	69.4	3.99	
Bonaparte	93	47	71.4	4.43	
Britt	91	45	69.4	4.74	
Buckingham				3.70	
Burlington	93	51	73.4	5.19	
Carroll	93	47	70.6	3.92	
Cedar Rapids	98	48	72.6	5.62	
Chariton	90	48	70.2	5.14	
Charles City	93	44	68.2	4.75	
Clarinda	95	50	72.0	7.28	
Clearlake	92	50	71.2	4.70	
Clinton	95	42	71.4	3.78	
College Springs	98	53	73.4	6.88	
Columbus Junction	92	47	71.6	3.84	
Corning	90	45	70.1	6.32	
Corydon	90	51	71.6	5.25	
Cresco	90	43	66.5		
Cumberland				4.71	
Decorah	92	43	67.9	2.84	
Delaware	92	45	69.0	3.38	
Denison	92	46	71.8	3.33	
Desoto	93	51	70.7	9.98	
Dows	91	48	69.1	3.65	
Earlham	90	43	67.9	6.33	
Elkader	99	42	71.0	3.05	
Estherville	93	44	67.2	4.50	
Fayette	93	38	67.4	4.37	
Florence				4.00	
Forest City	91	48	69.2	4.76	
Fort Dodge	95	49	70.6	2.21	
Fort Madison				4.43	
Galva	93	43	70.0	4.09	
Gilman				5.56	
Glenwood	90	53	70.8	5.20	
Grand Meadow	92	45	68.0	4.63	
Greene	94	46	70.0	3.06	
Greenfield	92	48	71.0	4.00	
Grinnell	94	49	70.8	5.55	
Grundy Center	93	48	69.7	5.38	
Guthrie Center	94	47	71.6	6.90	
Hampton	95	48	71.0	4.79	
Hanlontown	90	45	67.5	5.53	
Harlan	93	47	71.0	5.20	
Hopeville	91	51	71.2	5.24	
Humboldt	93	50	69.8	2.65	
Ida Grove	95	46	72.2	2.70	
Independence	92	45	67.9	3.73	
Indianola	94	50	71.9	5.37	
Inwood	94	40	69.4	3.78	
Iowa City	96	46	71.6	2.49	
Iowa Falls	93	47	68.9	3.86	
Jefferson				6.84	
Keosauqua	94	47	72.2	4.72	
Knoxville	93	49	71.6	3.31	
Lacona				6.47	
Larrabee	95	45	71.8	3.58	
Leclaire				4.04	
Lemars	93[i]	45[i]	69.6[i]	3.27	
Lenox	89	51	70.5	4.76	
Leon	90	50	71.6	5.34	
Logan	98	40	71.6		
Maple Valley				3.96	
Maquoketa	96	39	69.6	2.48	
Marshalltown	100	46	71.4	4.50	
Mason City	96	50	70.4	3.01	
Massena	94	49	71.8	4.70	
Montezuma				5.13	
Mountayr	93	51	72.2	4.14	
Mount Pleasant	97	50	73.8	3.92	
Mount Vernon	94	47	71.9	3.19	
New Hampton	90[h]	44[e]	66.8[e]	2.47	
Northwood	91	47	69.3	5.00	
Odebolt	96	46	73.0	2.82	
Ogden	92	49	70.0	1.64	
Olin	94	47	71.0	2.59	
Onawa	95	52	73.6	3.33	
Osage	92	44	68.6	3.21	
Osceola	93	49	71.2	4.35	
Oskaloosa	92	48	70.2	5.89	
Ottumwa	95	50	73.9	3.70	
Pacific Junction	92	49	71.5	5.00	
Perry	94	50	71.6	6.52	
Plover	94	47	69.8	1.28	
Pocahontas	94	47	70.8	1.42	
Primghar	90	47	68.4	5.76	
Redoak	89	54	72.2	6.66	
Ridgeway	99	48	71.2	3.65	
Rock Rapids	92	45	69.4	3.95	

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Iowa—Cont'd.	°	°	°	*Ins.*	*Ins.*
Rockwell City	95	48	71.5	2.86	
Sac City	94e	49e	70.4e	3.15	
St. Charles	93	52	71.4	4.92	
Sibley	90	44	66.8	4.51	
Sigourney	94	46	71.7	2.44	
Sioux Center	91	49	69.8	7.75	
Spirit Lake	.....	.....	.....	3.90	
Stockport	89	56	72.4	3.65	
Storm Lake	90	45	68.6	2.56	
Stuart	97	47	71.1	8.30	
Thurman	94	52	73.9	11.97	
Tipton	96	50	73.3	2.25	
Toledo	95	44	70.2	3.71	
Villisca	92	48	70.6	7.70	
Vinton	94	48	70.4	3.51	
Wapello	91	49	72.0	3.68	
Washington	92f	54g	72.4g	4.23	
Washta	.....	.....	.....	2.51	
Waterloo	98	46	70.0	3.56	
Waukee	97	52	73.6	9.31	
Waverly	93	48	69.4	4.07	
Westbend	92	44	69.0	2.25	
Whitten	94	48	71.1	6.05	
Wilton Junction	96	43	71.9	2.14	
Winterset	95	48	71.6	5.18	
Woodburn	.....	.....	.....	5.01	
Zearing	93	47	69.6	4.73	
Kansas.					
Achilles	102	49	72.4	4.64	
Alton	94i	57i	76.2i	4.21	
Anthony	.....	.....	.....	4.64	
Atchison	91	56	73.2	3.92	
Baker	92	53	74.0	5.96	
Beloit	96	54	78.0	1.83	
Burlington	93	53	76.1	8.33	
Chanute	95	56	77.2	8.01	
Chapman	92	56	74.6	6.46	
Clay Center	94	50	75.3	5.80	
Coffeyville	100	57	80.8	.....	
Colby	100	51	73.6	3.19	
Columbus	94	55	75.4	9.12	
Cunningham	95	59	76.9	8.97	
Dresden	100	55	74.1	3.22	
Eldorado	92	55	75.4	10.87	
Ellinwood	95	58	76.2	8.90	
Ellsworth	99h	55	76.7d	9.54	
Emporia	93	59	74.8	8.90	
Englewood	98	62	81.3	6.99	
Enterprise	93	56	73.5	7.49	
Eureka	.....	.....	.....	9.36	
Fall River	94d	52d	75.8d	12.93	
Farnsworth	98	52	73.9	4.20	
Forsha	95d	60d	75.8d	3.59	
Fort Leavenworth	95	57	75.4	8.85	
Fort Scott	96	53	76.1	8.12	
Frankfort	95	49	74.6	5.44	
Fredonia	92	57	75.8	8.93	
Garden City	98	53	76.9	5.65	
Gove*1	102	54	74.8	2.18	
Grenola	91	59d	74.8	7.93	
Harrison	95	46	73.0	4.11	
Holton	.....	51	.....	9.28	
Horton	94	55	73.6	7.80	
Hoxie	102	54	75.8	2.21	
Hugoton	100	56	76.2	3.70	
Hutchinson	94	55	74.0	9.37	
Independence	101	57	79.0	9.12	
Jetmore	102i	52i	77.8i	2.84	
La Crosse	100	54	76.8	2.55	
Lakin	103	53	76.1	2.10	
Larned	97	55	75.6	5.90	
Lebanon	94	50	74.0	4.20	
Lebo	94	55	74.4	7.53	
Macksville	98	55	77.2	2.25	
McPherson	96	56	76.6	10.86	
Madison	93	52	75.1	8.38	
Manhattan *b*	96	53	75.7	6.65	
Manhattan *c*	96	52	76.4	6.83	
Marion	93j	58f	76.6j	8.39	
Medicine Lodge	100	49	78.4	5.56	
Minneapolis	92	54	74.6	5.38	
Moran	92	55	75.6	9.54	
Mounthope	91	60	76.6	7.60	
Ness City	.....	.....	.....	2.99	
Newton	94	56	75.8	12.03	
Norton	98	53	74.6	3.92	
Norwich	95	58	77.0	5.97	
Oberlin	.....	.....	.....	2.36	
Olathe	93	50	74.6	6.60	
Osage City	93	51	75.0	5.92	
Osborne	.....	.....	.....	5.47	
Oswego	91	55	76.0	2.90	
Ottawa	93	51	74.6	7.33	
Paola	93e	53e	74.6e	8.05	
Phillipsburg	101	54	74.8	4.63	
Pleasanton	91	53	75.6	6.18	
Pratt	95	53	75.4	5.25	
Republic	94	49	74.0	4.95	
Rome	96	55	77.2	5.43	
Salina	96	56	76.0	8.90	
Sedan	94	54	76.5	6.66	
Toronto	94	51	75.7	7.85	
Ulysses	99	55	75.9	4.78	
Valley Falls	94	53	72.8	4.96	
Viroqua	100	50	75.0	2.45	
Wakeeney	.....	.....	.....	6.59	
Wallace	101	50	73.2	2.60	
Walnut	92	59e	76.9e	7.88	
Wamego*1	92	58	76.4	8.30	
Winfield	94	55	75.9	8.96	
Yates Center	93	53	75.8	9.01	
Kentucky.					
Alpha	93	54	74.6	1.95	
Anchorage	96	49	74.4	2.67	
Bardstown	99	51	77.0	1.59	
Beattyville	95	49	74.8	4.51	
Beaver Dam	97	52	76.0	3.81	
Berea	98d	48	75.5	2.29	
Blandville	94	59	75.8	4.13	
Bowling Green	96	53	76.1	4.09	
Burnside	95	51	74.6	3.86	
Cadiz	99	56	77.6	4.61	
Calhoun	97	54	76.7	2.20	
Catlettsburg	94	55	74.4	1.28	
Earlington	95	54	76.0	5.90	
Edmonton	93	54	74.5	4.26	
Eubank	93	47	72.3	2.13	
Falmouth	.....	.....	.....	0.96	
Fords Ferry	94	52	75.0	5.23	
Frankfort	93	51	74.8	1.55	
Franklin	91	58	76.4	5.70	
Greensburg	98	47	75.6	2.84	
Highbridge	97	51	75.1	3.33	
Hopkinsville	97	54	75.8	3.95	
Irvington	94	55	76.0	3.69	
Jackson	93	53	73.6	4.03	
Leitchfield	92	54	74.0	2.49	
Loretto	96	46	74.2	3.10	
Mayfield	91	59e	75.6	6.93	
Maysville	98	52	75.2	3.54	
Middlesboro	92e	52e	73.2e	4.00	
Mount Sterling	94	51	74.5	4.12	
Owensboro	93	56	75.5	3.28	
Owenton	.....	.....	.....	3.70	
Paducah *a*	.....	.....	.....	6.38	
Paducah *b*	96	60	78.8	6.27	
Princeton	94	56	76.3	6.87	
Richmond	95	54	74.9	2.74	
St. John	92	50	73.2	2.75	
Scott	97	50	74.8	1.08	
Shelby City	95	48	73.2	2.39	
Shelbyville	98	52	76.3	2.30	
Taylorsville	95	52	74.6	1.86	
Williamsburg	94	53	74.1	2.16	
Williamstown	95	50	74.1	2.08	
Louisiana.					
Abbeville	96	67	80.0	8.91	
Alexandria	96	65	80.0	7.74	
Amite	96	65	79.6	6.64	
Baton Rouge	98	67	80.9	7.66	
Burnside	92	62	78.7	5.61	
Calhoun	96f	58g	79.0g	.....	
Cameron	90	67	80.9	9.94	
Caspiana	98	65	81.8	4.10	
Cheneyville	96	65	80.0	9.65	
Clinton	92	66	78.3	6.91	
Collinston	96	64	80.2	6.97	
Covington	95	64	80.3	8.80	
Donaldsonville	.....	.....	.....	5.51	
Emilie	95	67	79.4	3.74	
Farmerville	93	66	80.6	2.99	
Franklin	95	67	80.1	10.06	
Grand Coteau	94	69	80.7	9.12	
Hammond	93	67	79.3	7.01	
Houma	94	65	79.4	9.21	
Lafayette	93	66	79.0	8.75	
Lake Charles	94	67	80.0	10.85	
Lakeside	94	69	79.9	5.03	
Lawrence	94	68	80.6	5.61	
Leesville	97	58	79.0	3.86	
Libertyhill	99	63	81.0	6.84	
Logansport	.....	.....	.....	3.98	
Mansfield	96e	63e	78.6e	2.72	
Melville	95	64	79.8	11.63	
Minden	100	56	79.2	4.59	
Monroe	95	66	79.9	7.86	
New Iberia	89e	68e	78.7e	9.93	
Opelousas	93	66	79.6	8.78	
Oxford	97	64	80.8	3.80	
Plain Dealing	96	60	79.4	5.36	
Port Eads	90d	68	80.4	7.34	
Rayne	95	67	80.0	11.31	
Reserve	98	69	82.0	3.98	
Robeline	97	64	80.0	5.41	
Ruston	97	62	80.1	5.97	
Schriever	96	64	79.6	11.67	
Louisiana—Cont'd.	°	°	°	*Ins.*	*Ins.*
Southern University	.....	.....	.....	6.46	
Sugar Experiment Station	93	68	80.7	6.47	
Sugartown	94	65	79.8	6.44	
Venice	91	66	78.4	8.59	
Maine.					
Bar Harbor	92	48	65.5	1.72	
Belfast	91	45	66.5	1.23	
Chesuncook	.....	.....	.....	4.23	
Cornish	93	46	68.6	2.24	
Danforth	.....	.....	.....	2.56	
Fairfield	87	47	68.4	2.69	
Farmington	89	42	67.8	4.97	
Gardiner	89	46	69.5	1.25	
Grant Farm	.....	.....	.....	3.96	
Houlton	89	47	69.0	2.58	
Lewiston	89	49	69.6	2.39	
Madison	86	45	68.0	6.10	
Mayfield	84	45	66.2	4.41	
Millinocket	90	47	63.9	4.96	
North Bridgton	88	46	69.0	2.96	
Oquossoc	93	40	64.9	2.89	
Orono	87	46	68.8	2.43	
Patten	87	43	66.4	4.30	
Rumford Falls	89	46	68.1	2.34	
South Lagrange	88	42	68.2	4.77	
The Forks	.....	.....	.....	7.53	
Thomaston	89	44	66.3	1.95	
Vanburen	95	39	67.8	4.85	
Winslow	89d	45d	68.2d	2.52	
Maryland.					
Annapolis	96	58	76.6	5.98	
Bachmans Valley	94	50	71.9	3.80	
Boettcherville	102	44	73.8	2.46	
Cambridge	98	57	77.4	5.09	
Chase	96	41	75.0	5.13	
Cheltenham	93	53	74.1	4.31	
Chestertown	91	54	73.6	5.38	
Chewsville	94	44	72.0	4.56	
Clearspring	92	50	71.0	4.16	
Coleman	96	56	75.0	4.53	
Collegepark	93e	50e	74.4e	4.07	
Colora	.....	.....	.....	5.03	
Cumberland	.....	.....	.....	1.44	
Darlington	95f	44	72.8e	6.24	
Deerpark	87d	35d	61.6d	5.07	
Denton	95	52	74.9	4.70	
Easton	92	54	74.6	4.25	
Fallston	96	52	72.5	3.97	
Frederick	94	49	74.5	4.54	
Grantsville	90	43	66.7	1.93	
Greatfalls	96	53	74.4	7.18	
Greenspring Furnace	95	49	73.0	4.56	
Hancock	100	46	74.4	3.01	
Harney	.....	.....	.....	8.28	
Jewell	92	56	71.8	7.02	
Johns Hopkins Hospital	97	57	76.2	4.94	
Laurel	95	56	75.5	4.84	
Mount St. Marys College	.....	46	.....	8.32	
New Market	91	51	72.9	5.81	
Oakland	87	37	65.4	4.78	
Pocomoke City	93	57	76.1	4.13	
Princess Anne	91	52	73.9	7.89	
Solomons	96	62	76.6	4.81	
Sudlersville	.....	55h	.....	.....	
Takoma Park	95	51	73.6	6.10	
Van Bibber	93	54	73.0	5.36	
Westernport	92	45	70.8	4.96	
Massachusetts.					
Amherst	94	46	70.4	2.62	
Bedford	86	50	68.7	1.78	
Bluehill (summit)	87	50	69.0	2.52	
Cambridge	90	50	71.5	1.68	
Chestnuthill	94	47	71.3	1.48	
Concord	88	46	69.2	2.21	
East Templeton	91	52	71.3	1.78	
Fall River	85	54	70.0	2.12	
Fitchburg *a**1	89	52	69.8	2.20	
Fitchburg *b*	94	48	69.8	2.44	
Framingham	93	48	71.0	2.14	
Groton	90	45	68.8	2.68	
Hyannis	.....	.....	.....	4.78	
Jefferson	.....	.....	.....	4.76	
Lawrence	89	49	69.8	3.18	
Leominster	.....	.....	.....	2.41	
Lowell *a*	92	50	72.4	1.83	
Lowell *b*	92	48	71.0	.....	
Ludlow Center	83	41	65.4	2.90	
Middleboro	88	44	69.2	2.45	
Monson	89	46	69.1	3.85	
New Bedford	86	53	68.6	2.22	
Plymouth*1	87	58	71.5	4.02	
Princeton	.....	.....	.....	3.83	
Provincetown	90	54	69.8	3.02	
Salem	.....	.....	.....	1.39	
Somerset*1	97	52	72.7	1.80	
Sterling	.....	.....	.....	3.14	
Taunton	87	44	69.2	2.45	
Westboro	92	45	71.0	2.49	

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Massachusetts—Cont'd.	°	°	°	*Ins.*	*Ins.*
Weston	89	47	69.0	1.93	
Williamstown	88	44	66.8	1.60	
Winchendon				2.51	
Worcester	94	50	71.4	3.13	
Michigan.					
Adrian	95	45	70.4	3.40	
Agricultural College	94	45	69.2	1.97	
Allegan	92[f]	50[f]	71.4[f]	2.24	
Alma	94	43	69.0	3.11	
Ann Arbor	97	45	70.8	1.98	
Arbela	95	43	70.2	3.44	
Baldwin	95				
Ball Mountain	91	41	68.3	2.02	
Baraga	92	40	66.0		
Battlecreek	94	46	69.8	2.80	
Bay City	97	45	69.8	2.75	
Benzonia	89[m]	45[n]	67.2[n]	3.56	
Berlin	98	39	68.4	1.81	
Berrien Springs	94[g]	41[g]	70.0[g]	3.23	
Big Rapids	92	37	65.9	4.98	
Birmingham	94	44	69.2	3.61	
Calumet	82[m]	45	61.8[g]	1.95	
Carsonville	95[f]	40[f]	69.1[f]		
Cassopolis	94	47	71.9	2.40	
Charlevoix	95	50	65.8	1.22	
Chatham	90	35	60.6	2.28	
Cheboygan	95	42	65.6	1.81	
Clinton	95	44	70.2	1.48	
Coldwater	95	43	70.2	4.70	
Deer Park	92	40	59.8	2.21	
Detour	89	48	63.8	1.31	
Dundee	95	45	71.1	2.84	
Eagle Harbor	90	42	60.4	2.15	
East Tawas	97[e]	42[e]	65.5[e]	6.40	
Eloise	97	44	70.3	2.52	
Ewen	92	33	60.4	1.91	
Fennville	91	45	68.7	3.85	
Fitchburg	96	43	68.4	1.25	
Flint	95	45	68.5	2.68	
Gaylord	92	39	62.3		
Gladwin	99	39	66.7	4.10	
Grand Haven	89	48	67.2	2.40	
Grand Marais	87	41	58.5	1.97	
Grape	98	44	69.6	2.96	
Grayling	92	41	66.2	3.30	
Hagar	94	43	69.3	3.34	
Harbor Beach	96	42	66.6	3.66	
Harrison	97	42	67.8	2.63	
Harrisville	98	44	65.6	2.61	
Hastings	94	42	69.6	1.91	
Hayes	96	40	69.0	3.02	
Highland				2.53	
Hillsdale	92	46	69.4	6.29	
Howell				0.97	
Humboldt	90[d]	32	59.4		
Iron Mountain	94	42	65.0	2.48	
Iron River	93	35	61.4	3.10	
Ironwood	93	42[d]	64.4	2.83	
Ishpeming	89[e]	42[e]	63.1[e]	5.24	
Ivan	93	36	66.0	3.30	
Jackson	98	45	70.2	2.21	
Jeddo	96	41	68.0	1.94	
Kalamazoo	96	45	71.7	2.72	
Lansing	93	45	69.5	2.15	
Lapeer	95	41	70.4	1.86	
Ludington	85				
Mackinac Island	85	47	64.8	2.52	
Macinaw City	90	42	63.9	2.10	
Mancelona	94	36	65.0		
Manistee	92	40	65.6	2.50	
Marine City	95	38	67.0	4.61	
Menominee	92	47	66.1	2.45	
Midland	96	45	69.1	3.51	
Mio	90	38[g]	63.2[g]	3.15	
Montague	90	41	67.8	2.78	
Muskegon	89	48	67.9	4.53	
Newberry	87	34	60.2	2.30	
Old Mission	94	48	67.2	1.36	
Olivet	91	48	69.2	3.19	
Omer	95	35	64.4	5.58	
Onaway	95	40	65.2	1.95	
Ovid	93			2.48	
Owosso	95				
Petoskey	95	46	65.2	4.28	
Plymouth	98				
Port Austin	97[g]	40[g]	69.3[g]		
Powers	89	40	64.0		
Reed City	93	34	65.4	3.02	
Roscommon	93[h]			2.30	
Saginaw (W. S.)	96	44	70.2	4.44	
St. Ignace	85	40	64.2	2.09	
St. Joseph				1.10	
Slocum	92	40	67.8	2.68	
South Haven		46		3.71	
Stanton	93	40	66.6	2.95	
Thomaston	94	35	61.6	3.67	
Thornville	94	43	69.7	3.37	
Traverse City	94	46	67.1	1.82	

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Michigan—Cont'd.	°	°	°	*Ins.*	*Ins.*
Vassar	97	35	69.4	1.91	
Wasepi	91	44	69.4	8.27	
Webberville	93	44	68.9	2.33	
West Branch	96[e]	40[b]	67.6[b]	1.39	
Wetmore	90	32[e]	61.1	1.60	
Whitefish Point	88	41	56.0	2.15	
Ypsilanti	96	44	68.0	3.03	
Minnesota.					
Albert Lea	91	45	68.0	4.37	
Alexandria	89	43	65.2	2.78	
Angus	88	38	62.8	2.36	
Ashby	87	47	65.0	2.71	
Beardsley	92[j]	34[j]	65.0[j]	2.25	
Beaulieu	88[l]	37[l]	61.8[l]	1.64	
Bemidji	90	43	67.1	2.06	
Bird Island	93	48	66.5	3.06	
Brainerd	92	44	65.3	3.70	
Caledonia	92	53	69.9	4.33	
Collegeville	91	50	66.9	5.19	
Crookston	92	44	64.8	2.02	
Deephaven				3.95	
Detroit City	87	41	62.2	2.62	
Faribault	91	45	65.8	5.33	
Farmington	89	46	67.0	4.52	
Fergus Falls	91	47	65.9	2.43	
Glencoe	91	44	65.8	2.35	
Grand Meadow	91	47	67.6	4.23	
Hallock	88	37	62.6	4.54	
Lake Winnibigoshish	88	42	64.1	4.39	
Leech	92	40	63.2	3.82	
Long Prairie	91	38	65.2	4.17	
Luverne	90	44	67.0	4.47	
Lynd	90	44	66.2	4.24	
Mapleplain	92	46	67.0	4.88	
Milaca	91	40	64.6	4.48	
Milan	89	45	65.9	5.31	
Minneapolis [1]	95[e]	47	67.6	4.65	
Montevideo	93	46	68.0	4.89	
Mora	92	42	63.8	3.01	
Morris	90	46	66.1	5.08	
Mount Iron	94	35	59.8	4.55	
New London	92	46	68.2	9.15	
New Richland	92[e]	49[e]	69.0[e]	2.51	
New Ulm	96	48	69.5	6.02	
Park Rapids	89	41	63.6	2.42	
Pine River	92	40	67.1	3.30	
Pipestone	92	49	67.3	4.99	
Pleasant Mounds	90	47	67.3	5.21	
Pokegama Falls	91	34	60.7	4.76	
Redwing [a]				4.56	
Reeds				2.64	
Rolling Green	89	48	68.6	6.52	
St. Charles	90	42	66.8	5.27	
St. Cloud	95	48	68.0	5.87	
St. Peter	92	45	68.2	4.28	
Sandy Lake Dam	92	40	63.9	2.69	
Shakopee	92	48	68.3	3.06	
Two Harbors	85	41	61.2	2.80	
Wabasha	96	45	69.4	2.75	
Wadena	90	37	63.4	2.55	
Willow River	93	37	63.9	2.75	
Winnebago	93	47	69.8	4.05	
Winona	92	47	68.5	2.16	
Worthington	91	47	68.2	3.91	
Zumbrota	92	42	67.6	4.11	
Mississippi.					
Aberdeen	101	58	80.0	8.43	
Agricultural College	94	63	79.2	3.02	
Austin	96	58	78.4	5.93	
Batesville	97	53	78.4	4.31	
Bay St. Louis	92	67	79.6	13.57	
Biloxi	93	68	80.8	9.99	
Booneville	93	60	77.6	3.48	
Brookhaven	98	60	80.0	6.10	
Canton	96	61	78.8	6.44	
Columbia	96[f]	62[f]	78.7[f]		
Columbus	94	59	77.6	3.94	
Corinth	90	60	76.8	4.23	
Crystal Springs	94[e]	60[b]	77.8[e]	6.68	
Duck Hill	97	55	79.0	5.05	
Edwards	94	60	78.2	8.19	
Fayette	93	62	78.2	13.22	
Fayette (near)				9.44	
Greenville [a]	93	64	79.7	3.41	
Greenville [b]	95[f]	63[e]	80.6[d]	4.41	
Greenwood	95	59	79.4	6.66	
Hazlehurst	94	60	79.0	6.56	
Hernando	93	60	78.0	7.15	
Holly Springs	95	63	78.0	4.76	
Indianola	97	60	79.4	5.33	
Jackson	95	61	79.1	7.88	
Kosciusko	98	60	77.7	7.78	
Lake	97	57	78.2	6.21	
Lake Como	98	55	78.5	6.65	
Laurel	96	59	80.2	8.07	
Leakesville	99	61	79.0	8.96	
Louisville	96	59	77.8	4.47	
Macon	100	60	80.3	5.16	

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Mississippi—Cont'd.	°	°	°	*Ins.*	*Ins.*
Magee	95	58	77.8	8.98	
Magnolia	97	64	79.4	8.51	
Natchez	97	60	80.2	10.53	
Nitta Yuma	95	62	79.6	6.17	
Okolona	102	58	81.2	2.25	
Patmos				4.92	
Pearlington	93	67	79.2	5.01	
Pittsboro	98	55	78.2	3.76	
Pontotoc	93	60	75.8	8.95	
Poplarville	93	64	78.1	7.55	
Port Gibson	96	61	79.8	7.56	
Ripley	92	54	75.0	3.90	
Shelby				6.46	
Shoccoe	98	57	78.0	4.83	
Stonington				11.30	
Suffolk	95	61	78.2	8.50	
Swartwout	97	63	79.8	9.06	
Tupelo	97	56	78.2	7.61	
University	95	61	78.5	5.87	
Utica	93	61	79.4	7.84	
Walnutgrove	95	60	77.8	6.70	
Watervalley	97	56	79.0	5.70	
Waynesboro	97	58	80.0	7.04	
Woodville	95	66	79.8	7.30	
Yazoo City	96	61	79.2	7.25	
Missouri.					
Appleton City	94	56	75.8	4.44	
Arthur	92	54	74.8	5.99	
Avalon	92	54	73.9	6.48	
Bagnell				1.96	
Bethany	91	49	70.2	3.73	
Birchtree	92[d]	57[d]	74.5[d]	4.73	
Blue Springs	90[e]	52[e]	73.2[e]	5.25	
Boonville				2.76	
Brunswick	93	52	73.8	7.56	
Caruthersville	97	55	77.3	3.58	
Conception	90	54	72.8	4.84	
Darksville	91	53	72.7	5.91	
Dean	93	51	75.2	9.23	
Desoto	92	54	74.8	2.50	
Doniphan	94[f]	55[a]	75.4[d]	5.89	
Downing				2.57	
Fairport				3.88	
Fayette	91	52	71.8	2.31	
Fulton	92	49	73.1	2.37	
Gallatin *[1]	96	60	74.7	4.49	
Gano	92	51	74.3	3.29	
Glasgow	93	55	74.4	2.51	
Gorin				3.23	
Grant City	91	53	71.7	6.16	
Halfway	89	54	74.2	4.72	
Harrisonville	94	55	75.0	5.99	
Hazlehurst				3.89	
Hermann				4.68	
Houston	91	49	73.2	1.90	
Huntsville	93[f]	54[f]	74.2[f]	6.86	
Ironton	93	49	73.9	4.30	
Jackson	95	53	75.6	2.60	
Jefferson City	93	54	74.8	2.59	
Joplin	93	56	76.0	8.07	
Kidder	92	53	72.9	5.79	
Koshkonong	93	56	75.0	4.47	
Lamar	93	54	76.2	6.38	
Lamonte				4.57	
Lebanon	96	54	74.6	5.30	
Lexington	92	54	74.5	5.78	
Liberty	91	57	73.7	10.93	
Lockwood				5.33	
Louisiana	93	48	73.6	3.42	
Macon	94	53	74.3	4.06	
Marblehill	93	54	75.0	4.81	
Maryville	96	54	73.2	7.60	
Mexico	96	52	74.2	1.88	
Miami *[b]	95	60	76.0	4.18	
Monroe City	93	50	72.6	3.61	
Montreal	92	47	73.0	2.32	
Mountaingrove	90[d]	55	73.6	3.77	
Mount Vernon	94	52	74.2	10.81	
Neosho	92	49	74.4	8.87	
Nevada				6.00	
New Haven	94	57	75.6	2.91	
New Madrid				4.64	
New Palestine	93	57	74.4	2.98	
Oakfield	92	56	74.6	2.95	
Olden	97	53	74.8	2.06	
Oregon	93	53	73.9	5.42	
Palmyra *[b]	94	62	76.8	5.40	
Pine Hill				3.43	
Princeton	100	52	74.8	3.97	
Protem	100	54	75.8	2.92	
Rockport				5.89	
Rolla				3.19	
St. Charles	92	55	74.6	5.02	
St. Joseph				4.63	
Sarcoxie				9.88	
Sedalia	92	57	74.5	3.61	
Seymour	90	50	72.1	4.03	
Sikeston	92	56	75.0	8.03	

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Missouri—Cont'd.	°	°	°	*Ins.*	*Ins.*
Steffenville	92	51	72.8	7.68	
Sublett	94	49	73.2	5.27	
Trenton	92	55	73.2	5.56	
Unionville	92	50	72.0	5.56	
Versailles	92	54	74.0	2.79	
Warrensburg	92	55	75.5	7.51	
Warrenton	94	54	74.4	4.97	
Warsaw	92	49	72.5	3.91	
Wheatland	.....	.....	.....	3.48	
Willowsprings	94	50	73.3	1.63	
Windsor	91	54	73.9	2.73	
Zeitonia	95	52	74.8	3.73	
Montana.					
Adel	89	32	60.6	2.81	
Anaconda	90	39	62.4	.....	
Augusta	.....	37	.....	1.20	
Boulder	86	38	62.0	0.77	
Bozeman	88	36	62.2	1.11	
Butte	85	37	62.2	2.00	
Canyon Ferry	92	41	66.1	1.92	
Cascade	99	41	68.6	0.29	
Chester	97	40	70.0	0.11	
Chinook	103[e]	42[e]	70.4[e]	0.73	
Columbia Falls	95	33	65.1	0.60	
Crow Agency	98	45	69.6	1.05	
Culbertson	97	40	65.6	2.87	
Dayton	96	42	70.2	1.50	
Deerlodge	85	35	60.5	.....	
Dillon	88	32	61.5	0.05	
Fort Benton	100	44	68.8	.....	
Fort Harrison	92	40	67.5	.....	
Glasgow	101	38	70.2	0.35	
Glendive	98	42	68.1	0.15	
Grayling	82	25	53.4	1.67	
Greatfalls	97	48	69.5	0.97	
Hamilton	93	39	65.2	0.18	
Hayden	99	32	67.2	.....	
Lame Deer	98	40	69.0	1.70	
Lewistown	90	32	62.5	3.45	
Lodge Grass	.....	40[e]	.....	1.31	
Marysville	87	36	61.7	1.63	
Missoula	97	42	69.7	0.31	
Ovando	95	33	61.2	0.54	
Parrot	94	31	65.7	.....	
Philipsburg	91	32	61.0	0.26	
Plains	94	40	65.0	0.98	
Poplar	97	40	69.2	1.40	
Redlodge	87	37	61.0	0.66	
Ridgelawn	100	40	67.8	0.15	
St. Pauls	93	41	68.6	1.30	
St. Peter	93	41	64.4	0.66	
Springbrook	99	34	68.0	0.54	
Toston	92	38	65.7	1.79	
Townsend	.....	.....	.....	1.29	
Troy	97	.....	64.4	1.16	
Twin Bridges	98[e]	34[e]	64.0[e]	1.10	
Utica	92	42	64.1	3.25	
Wibaux	98[e]	34[e]	71.4[e]	T.	
Wolf Creek	93	37	63.8	0.97	
Yale	96	43	66.4	1.52	
Nebraska.					
Agate	93	37	66.3	2.46	
Albion	92	47	69.1	5.88	
Alliance	98	36	70.2	3.27	
Alma	99	49	73.4	2.23	
Ansley	97	46	71.6	6.60	
Arapahoe	.....	.....	.....	1.84	
Arcadia	.....	.....	.....	8.12	
Ashland *a*	94	53	72.6	3.40	
Ashland *b*	.....	.....	.....	3.88	
Ashton	.....	.....	.....	9.07	
Auburn	92	50	72.0	8.49	
Aurora	93[e]	50	72.2	3.82	
Bartley	104	49	74.1	4.54	
Beatrice	92	52	73.2	5.21	
Beaver	102	52	74.6	0.83	
Bellevue	.....	.....	.....	5.13	
Benkleman	.....	.....	.....	2.69	
Bethany	.....	.....	.....	5.28	
Blair	94	49	71.2	4.87	
Bluehill	.....	.....	.....	2.75	
Bradshaw	.....	.....	.....	5.05	
Bridgeport	96	45	69.2	2.56	
Broken Bow	93	48	70.2	6.50	
Burchard	.....	.....	.....	3.32	
Burge	.....	.....	.....	4.14	
Burwell	.....	.....	.....	6.69	
Callaway	91	48	70.6	6.32	
Central City	.....	.....	.....	5.48	
Chester	.....	.....	.....	5.20	
Columbus	95	50	71.9	4.94	
Crawford	.....	.....	.....	0.87	
Crete	91	51	72.0	6.77	
Culbertson	100	50	75.1	1.60	
Curtis	97	49	71.4	3.48	
David City	92	52	70.9	5.20	
Dawson	93	52	73.8	5.78	
Edgar	.....	.....	.....	3.17	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Nebraska—Cont'd.	°	°	°	*Ins.*	*Ins.*
Ericson	.....	.....	.....	6.73	
Ewing	.....	.....	.....	5.10	
Fairbury	94	46	73.2	4.09	
Fairmont	92	49	71.8	4.71	
Fort Robinson	98	40	67.9	0.93	
Fremont	93	50	71.2	4.82	
Fullerton	.....	.....	.....	7.88	
Geneva	94	49	73.0	5.20	
Genoa (near)	93	53	73.6	7.60	
Gering	100	42	70.6	2.15	
Gordan	.....	.....	.....	1.32	
Gothenburg	98	48	71.6	5.16	
Grand Island *a*	96	50	74.2	5.25	
Grant	.....	.....	.....	6.12	
Greeley	.....	.....	.....	7.30	
Guide Rock	.....	.....	.....	3.94	
Haigler	.....	.....	.....	1.46	
Halsey	94	47	70.2	5.28	
Hartington	92	47	69.4	2.26	
Harvard	91	49	71.2	6.33	
Hastings [1]	93	56	73.7	3.46	
Hayes Center	.....	.....	.....	2.95	
Hay Spring	96	40	67.4	2.16	
Hebron	93	48	73.2	4.24	
Holbrook	.....	.....	.....	3.71	
Holdrege	95	49	72.3	2.82	
Holly	.....	.....	.....	3.34	
Hooper [1]	96	56	72.7	6.12	
Imperial	88	44	67.4	3.62	
Johnstown	.....	.....	.....	5.44	
Kearney	101	53	74.8	4.73	
Kennedy	97	45	69.4	2.84	
Kimball	93	42	67.8	2.68	
Kirkwood	101	46	71.0	4.70	
Leavitt	96	50	73.4	6.27	
Lexington	97	50	70.6	6.52	
Lockridge	93	51	71.8	4.82	
Lodgepole	91	47	67.2	3.47	
Loup	95	48	71.0	10.04	
Lynch	98	45	71.8	5.04	
McCook	.....	.....	.....	1.16	
McCool Junction	.....	.....	.....	3.70	
Madison	92	49	70.0	3.73	
Madrid	95	42	70.2	3.71	
Merriman	.....	.....	.....	6.92	
Marquette	.....	.....	.....	5.46	
Mason	.....	.....	.....	2.48	
Minden	93	46	71.2	4.10	
Monroe	.....	.....	.....	6.79	
Nebraska City	94	49	72.6	4.39	
Nemaha	.....	.....	.....	6.46	
Norfolk	95	48	71.6	4.64	
North Loup	99	47[e]	72.2[e]	4.74	
Oakdale	95	46	70.7	4.87	
Odell	.....	.....	.....	4.05	
O'Neil	99	49	70.4	3.80	
Ord	.....	.....	.....	5.68	
Osceola	.....	.....	.....	7.17	
Palmer	.....	.....	.....	9.18	
Palmyra [1]	92	60	73.4	7.10	
Pawlet	.....	.....	.....	1.58	
Pawnee City	94	49	73.6	6.30	
Plattsmouth *a*	.....	.....	.....	4.82	
Plattsmouth *b*	.....	52	.....	4.81	
Purdum	98	46	69.4	4.75	
Ravenna *a*	95	50	71.3	7.48	
Ravenna *b*	.....	.....	.....	7.49	
Redcloud	95	49	73.0	6.30	
Republican	.....	.....	.....	3.14	
Rulo	.....	.....	.....	7.75	
St. Libory	.....	.....	.....	11.53	
St. Paul	94	50	71.8	9.00	
Santee	95	47	72.3	3.86	
Schuyler	.....	.....	.....	4.67	
Seneca	.....	.....	.....	3.38	
Seward	93	54	73.4	4.13	
Smithfield	.....	.....	.....	3.40	
Spragg	.....	.....	.....	7.44	
Springview	96	47	69.5	5.54	
Stanton	94	48	71.4	5.26	
Strang	.....	.....	.....	6.15	
Stratton	.....	.....	.....	2.69	
Stromsburg	.....	.....	.....	6.07	
Superior	96	50	73.2	5.52	
Syracuse	.....	.....	.....	8.22	
Tablerock	.....	.....	.....	5.18	
Tecumseh *b*	96	53	74.9	5.16	
Tekamah	95	51	72.6	4.20	
Turlington	93	53	72.2	5.44	
University Farm	94	51	73.0	5.03	
Wahoo	.....	.....	.....	2.57	
Wakefield	94	45	69.6	3.45	
Wallace	.....	.....	.....	2.41	
Wauneta	.....	.....	.....	2.99	
Weeping Water	.....	.....	.....	4.36	
Westpoint	94	49	71.0	4.96	
Whitman	.....	.....	.....	1.90	
Wilber	.....	.....	.....	6.06	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Nebraska—Cont'd.	°	°	°	*Ins.*	*Ins.*
Wilsonville	.....	.....	.....	5.68	
Winnebago	91	41	69.0	4.44	
Wisner	.....	.....	.....	4.00	
Wymore	.....	.....	.....	2.53	
York	95[b]	55[b]	75.0[b]	5.68	
Nevada.					
Austin	90	43	68.0	0.31	
Battle Mountain	106	40	70.1	T.	
Beowawe [1]	100	39	61.2	0.20	
Belmont	90[e]	40[e]	66.3[e]	0.21	
Candelaria	93	45	70.9	0.15	
Carlin [1]	99	54	71.7	.....	
Carson City	94	38	66.4	T.	
Cranes Ranch	.....	.....	.....	0.76	
Dyér	96	41	68.8	0.01	
Elko	101	34	66.9	1.90	
Ely	93	40	66.5	0.29	
Eureka	110	39	71.8	1.50	
Fallon	98	48	73.7	0.10	
Fenelon [1]	96	49	70.7	.....	
Geyser	98	32	65.8	0.54	
Glenbrook	.....	.....	.....	0.00	
Golconda [1]	.....	.....	.....	0.30	
Halleck [1]	96	60	73.1	2.46	
Hawthorne	99	50	75.2	0.13	
Lewers Ranch	92	38	67.2	0.00	
Lovelocks [1]	100	42	72.4	0.77	
Martins	102	37	71.1	0.15	
Mill City [1]	.....	.....	.....	0.00	
Morey	105	41	71.9	1.19	
Palisade	98	36	68.2	1.29	
Palmetto	90	35	64.2	3.82	
Pioche	103	41	70.5	0.94	
Potts	97	30	64.5	T.	
Reno State University	93	39	68.3	T.	
Sodaville	107	51	78.4	1.15	
Toano	102	40	75.6	0.28	
Wabuska	98	36	70.0	0.35	
Wadsworth	95	.....	.....	0.00	
Wells [1]	98	41	73.0	0.78	
Wood	91	37	63.8	0.51	
New Hampshire.					
Alstead	90	44	67.7	1.75	
Bartlett	.....	.....	.....	1.99	
Bethlehem	88	44	66.0	3.08	
Bretton Wood	.....	.....	.....	3.19	
Brookline [1]	94	45	71.3	1.66	
Chatham	89	41	66.2	3.05	
Concord	94	42	68.5	3.11	
Durham	89	44	69.0	1.23	
Franklin Falls	97	44	69.2	1.49	
Grafton	96[b]	39[b]	66.8[b]	2.24	
Hanover	94	42	67.8	2.51	
Jefferson Highlands	.....	.....	.....	3.66	
Keene	94	41	68.9	2.48	
Nashua	95	47	71.6	1.85	
Newton	89	41	68.3	1.69	
North Woodstock	.....	.....	.....	3.07	
Plymouth	97	42	69.8	4.14	
Stratford	92	39	66.8	4.20	
New Jersey.					
Asbury Park	92	56	71.6	4.69	
Bayonne	97	56	73.3	5.85	
Belvidere	91	50	71.1	4.89	
Bergen Point	92	54	72.4	5.33	
Beverly	96	52	73.8	5.37	
Blairstown	96	48	72.0	4.36	
Bridgeton	98	53	76.1	4.35	
Canton	.....	.....	.....	5.72	
Cape May C. H.	92	52	73.3	3.92	
Charlotteburg	91	42	67.8	2.41	
Chester	91	50	69.0	4.82	
Clayton	92[e]	48[e]	72.3[e]	3.25	
College Farm	95	50	72.2	7.99	
Dover	92	47	68.2	4.23	
Englewood	93	52	71.5	5.14	
Flemington	96	49	72.6	4.61	
Friesburg	96	50	73.2	6.26	
Hightstown	92	52	72.6	7.29	
Imlaystown	94	54	73.6	4.62	
Indian Mills	96	50	73.4	4.06	
Lakewood	92	50	71.4	5.55	
Lambertville	94	51	73.4	6.20	
Layton	93	43	69.0	2.53	
Moorestown	92	52	72.4	5.69	
Newark	94	53	72.7	5.36	
New Brunswick	96	53	74.2	7.10	
Newton	94	52	72.2	6.00	
Oceanic	91	54	71.3	5.12	
Paterson	95	53	73.3	4.32	
Phillipsburg	94	52	72.5	4.77	
Plainfield	94	50	72.2	8.06	
Pleasantville	.....	.....	.....	3.36	
Rancocas	.....	.....	.....	6.40	
Rivervale	94	45	70.4	2.69	
Salem	98	52	74.7	4.97	
Sandy Hook	94	59	73.2	5.28	
Somerville	96	47	72.2	5.53	

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
New Jersey—Cont'd.	°	°	°	*Ins.*	*Ins.*
South Orange	91	53	71.6	5.88	
Sussex	92	49	70.4	3.01	
Trenton	94	56	73.8	6.21	
Tuckerton	93	48	72.8	2.79	
Vineland	97	48	73.4	3.63	
Woodbine	94	48	71.5	4.88	
Woodstown	.....	.....	.....	4.86	
New Mexico.					
Alamagordo	105	58	81.7	0.81	
Albert	101	55	78.6	4.16	
Albuquerque	99	53	76.8	0.94	
Alma	103[c]	36[c]	73.4[c]	1.00	
Arabela	93	53	72.0	3.26	
Bellranch	.....	.....	.....	2.68	
Cambray	.....	.....	.....	0.83	
Carlsbad	104	60	81.4	0.64	
Clouderoft	76	40	57.1	4.23	
Deming *1	102	.....	82.9	1.57	
Dorsey	95	43	69.0	1.60	
Eagle Rock Ranch	91	45	68.4	2.10	
Engle	97	49	75.3	0.50	
Fort Bayard	97	51	73.6	1.76	
Fort Stanton	90	50	70.2	2.87	
Fort Union	90	41	66.7	4.20	
Fort Wingate	91	48	69.0	2.55	
Fruitland	97	42	69.9	0.03	
Gage *1	101	.....	85.0	1.16	
Gallinas Spring	.....	.....	.....	1.54	
Golden	.....	.....	.....	2.07	
Las Vegas	93	45	68.8	4.95	
Lordsburg *1	101	.....	81.6	1.09	
Los Lunas	.....	58	.....	1.65	
Luna	94	35	66.9	2.10	
Maxwell (near)	92	41	67.6	2.25	
Mesilla Park	101	56	79.6	1.36	
Mountainair	94	42	69.5	1.11	
Raton	94	44	69.8	1.60	
Rociada	88	42	65.2	3.65	
Roswell	96	56	76.8	1.23	
San Marcial	105	48	77.0	0.26	
San Rafael	95	45	69.8	0.73	
Springer	95	43	71.1	1.80	
Strauss	.....	.....	.....	0.27	
Taos	96	43	69.0	0.77	
Vermejo	87	38	62.0	3.17	
Winsors	.....	.....	.....	2.93	
New York.					
Adams	.....	.....	.....	3.99	
Addison	93	46	69.2	4.53	
Akron	.....	.....	.....	4.72	
Alden	87	43	67.8	3.77	
Ames	.....	.....	.....	3.81	
Amsterdam	92	47	68.6	3.40	
Angelica	91[c]	42[c]	67.9[c]	6.54	
Appleton	92	44	68.0	3.86	
Arcade	.....	.....	.....	5.30	
Athens	92	52	71.5	2.77	
Atlanta	91	38	67.0	6.35	
Atwater	.....	.....	.....	7.82	
Auburn	88[h]	47[h]	68.2[h]	5.41	
Avon	89	45	67.9	7.28	
Baldwinsville	91	47	67.6	5.80	
Ballston Lake	92	48	69.1	5.85	
Bedford	96	50	71.6	2.07	
Berlin	94	44	69.2	2.05	
Blue Mountain Lake	.....	.....	.....	3.88	
Bolivar	90[c]	40[c]	66.1[c]	6.30	
Bouckville	89	45	66.2	8.85	
Brockport	92	46	70.2	3.67	
Caldwell	93	47	70.0	2.94	
Cape Vincent	82	49	66.6	2.80	
Carmel	89	56	69.6	6.11	
Carvers Falls	89	46	66.7	2.93	
Chazy	90	43	68.0	4.58	
Chatham	94[c]	49[c]	71.6[c]	1.53	
Cooperstown	88	46	66.4	4.74	
Cortland	92	45	68.5	7.55	
Cutchogue	90	53	70.8	1.80	
Deansboro	.....	.....	.....	7.30	
Dekalb Junction	88	42	67.6	4.42	
De Ruyter	88	44	64.8	9.62	
Easton	.....	.....	.....	5.54	
Elba	89	46	68.0	3.30	
Elmira	99	49	71.3	3.80	
Faust	89	35	65.6	3.90	
Fayetteville	93	50	69.5	5.18	
Fort Plain	92	50	70.5	3.40	
Franklinville	89	42	66.0	5.33	
Gabriels	90	34	62.6	3.07	
Gansevoort	.....	.....	.....	4.98	
Glens Falls	91	45	69.5	2.39	
Gloversville	91	46	67.5	3.09	
Greenwich	90[c]	47[c]	69.2[c]	4.87	
Griffin Corners	87	39	63.8	4.94	
Harkness	95	45	67.6	3.12	
Haskinville	.....	.....	.....	4.83	
Hemlock	88	49	69.4	5.02	
Homer	90	44	66.6	8.51	

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
New York—Cont'd.	°	°	°	*Ins.*	*Ins.*
Hunt	91	43	67.9	5.43	
Indian Lake	89	37	62.4	3.25	
Ithaca	91	48	68.4	3.79	
Jamestown	91	43	67.4	7.47	
Jeffersonville	91	42	67.3	7.34	
Keene Valley	93	42	65.2	4.26	
Lake George	88	47	68.5	3.33	
Lenox	.....	.....	.....	4.51	
Le Roy	88	47	67.8	3.60	
Liberty	87	43	65.8	4.02	
Littlefalls, City Res.	87	46	67.0	4.60	
Lockport	90	48	68.4	4.06	
Lowville	87	40	65.8	4.32	
Lyndonville	.....	.....	.....	4.45	
Lyons	94	50	71.2	3.74	
Middletown	91	52	70.7	3.60	
Mohonk Lake	85	54	67.4	2.90	
Moira	90	42	67.8	3.79	
Mount Ettrick	86	49	65.3	7.20	
Newark Valley	.....	.....	.....	4.89	
New Lisbon	87	40	64.4	5.92	
North Hammond	86	46	67.5	4.00	
North Lake	.....	.....	.....	3.53	
Number Four	83	40	63.3	6.30	
Ogdensburg	89	45	68.6	4.13	
Old Chatham	.....	.....	.....	1.60	
Oneonta	91	46	69.2	5.20	
Oswegatchie	86	41	65.6	5.44	
Otto	85	45	67.4	5.94	
Oxford	89	47	67.5	5.98	
Oyster Bay	90	52	71.4	3.01	
Palermo	.....	.....	.....	5.62	
Perry City	91	45	67.6	5.48	
Plattsburg Barracks	95	45	68.0	3.30	
Port Jervis	93	48	70.0	5.05	
Potsdam	89	42	68.3	4.75	
Primrose	93	47	70.8	6.45	
Redhook	.....	.....	.....	3.83	
Richland	90	42	68.7	7.67	
Richmondville	90	45	67.8	3.27	
Ridgeway	91	49	68.2	5.08	
Ripley	89	45	68.3	3.85	
Rome	.....	.....	.....	6.37	
Romulus	93	47	68.4	3.97	
Salisbury Mills	.....	.....	.....	5.73	
Saranac Lake	89	39	63.2	3.18	
Saratoga Springs	92	47	68.6	7.04	
Scarsdale	90	50	70.2	2.75	
Scottsville	.....	.....	.....	5.14	
Setauket	88	56	70.8	3.61	
Shortsville	89	48	68.2	5.57	
Skaneateles	.....	.....	.....	4.53	
Southampton	84	54	69.8	2.49	
South Butler	92	48	68.2	5.43	
South Canisteo	89	42	66.5	4.20	
South Kortright	89	40	66.2	4.54	
South Schroon	91	41	65.2	4.73	
Spier Falls	93	47	68.6	3.57	
Straits Corners	93	41	66.6	2.98	
Ticonderoga	90	48	69.9	2.79	
Volusia	85	43	65.6	4.07	
Wappinger Falls	90	52	71.0	5.23	
Warwick	.....	.....	.....	2.89	
Watertown	88	42	68.6	3.75	
Waverly	95	44	69.5	2.76	
Wedgwood	88	47	66.7	4.79	
Wells	91	42	65.3	3.16	
West Berne	90	45	68.0	4.82	
Westfield *b*	87	46	67.6	3.23	
Windham	90	44	67.3	3.95	
Youngstown	.....	.....	.....	4.01	
North Carolina.					
Brevard	90	49	69.4	2.54	
Bryson City	.....	.....	.....	3.53	
Currituck	.....	.....	.....	6.40	
Eagletown	95	58	76.4	4.51	
Edenton	96	60	78.2	7.80	
Fayetteville	95	63	77.8	8.02	
Flatrock	95	48	70.7	2.67	
Goldsboro	95	64	78.4	6.23	
Graham	.....	.....	.....	2.51	
Greensboro	95	58	75.9	4.37	
Henderson	94	61	75.8	8.85	
Hendersonville	91	50	69.8	3.65	
Henrietta	101	57	75.8	4.00	
Horse Cove	87	50	69.4	8.35	
Hot Springs	92	53	72.6	.....	
Jefferson	88	45	67.4	3.52	
Kinston	101	62	80.4	5.00	
Kittyhawk	92	68	77.8	6.38	
Lenoir *g*	97	51	75.0	.....	
Lexington	99	45	76.6	5.85	
Lincolnton	100	40	71.3	.....	
Linville	82	40	63.8	4.69	
Littleton	96	59	75.6	5.57	
Louisburg	95	60	77.0	5.78	
Lumberton	100	64	79.4	3.44	
Marion	97	53	74.2	7.17	

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
North Carolina—Cont'd.	°	°	°	*Ins.*	*Ins.*
Moncure	100	59	78.7	4.23	
Monroe	97	54	76.7	5.46	
Morganton	96	53	73.2	4.88	
Mountairy	103	50	75.4	3.80	
Murphy	.....	.....	.....	4.19	
Nashville	101	57	79.0	4.95	
Newbern	96	66	79.2	6.56	
Pantego	.....	.....	.....	5.38	
Patterson *1	90	52	71.2	7.40	
Penelo	98	58	77.8	3.93	
Pinehurst	100	62	79.2	6.84	
Pittsboro	97	55	78.0	3.27	
Reidsville	98	57	76.2	3.62	
Rockingham	98	62	78.9	7.55	
Salem	95	59	75.7	6.83	
Salisbury	99	57	76.4	6.26	
Saxon	98	54	73.8	4.27	
Scotland Neck	95	60	77.8	4.10	
Selma	99	62	78.7	8.93	
Settle	96	55	74.9	3.05	
Sloan	96	62	77.3	6.77	
Soapstone Mount	95	54	74.8	6.51	
Southern Pines *a*	98	62	78.8	9.33	
Southport	93	67	80.0	7.27	
Statesville	95	53	74.6	4.01	
Tarboro	101	58	79.8	4.87	
Washington	96	62	78.8	11.72	
Waynesville	85	47	69.8	2.17	
Weldon *a*	98	57	78.0	6.96	
Weldon *b*	.....	.....	.....	6.90	
Whiteville	96	62	78.6	4.85	
North Dakota.					
Amenia	88[c]	41[c]	64.7[c]	4.28	
Ashley	89	35	62.3	3.30	
Berlin	88	35	62.0	1.96	
Buxton	89[l]	42[l]	64.5[l]	2.12	
Cando	81	41	61.8	4.42	
Churchs Ferry	82	39	62.7	3.82	
Coalharbor	88	54	68.7	1.27	
Cooperstown	86	37	62.0	2.16	
Devils Lake	83	43	63.2	3.97	
Dickinson	100	39	66.6	0.32	
Donnybrook	89	39	64.0	2.09	
Dunseith	83	40	61.6	1.99	
Edgeley	88	43	64.8	2.79	
Ellendale	93	41	68.4	1.42	
Fargo	90	37	62.4	2.83	
Forman	92	45	66.6	1.39	
Fort Yates	99	45	67.0	1.84	
Fullerton	90	41	63.8	2.11	
Glenullin	94	45	65.8	1.22	
Grafton	88	40	64.6	2.45	
Hamilton	89	38	64.2	3.54	
Hannaford	90[k]	38[k]	63.8[l]	4.40	
Jamestown	89	42	64.2	2.23	
Kulm	87	44	63.3	3.05	
Lamoure	.....	.....	.....	2.92	
Langdon	80	39	60.8	3.72	
Larimore	86	36	62.8	2.86	
Lisbon	89	40	64.4	2.23	
McKinney	85	37	61.2	2.15	
Manfred	84	38	62.5	1.48	
Mayville	89	38	64.6	2.68	
Medora	102	38	68.0	0.20	
Melville	88[h]	41[h]	64.8[h]	2.03	
Milton	85	44	65.6	4.27	
Minnewaukon	83[g]	43[g]	64.3[g]	2.55	
Minot	90[c]	40[c]	66.8[c]	3.20	
Minto	90	34	62.1	2.78	
Napoleon	91	40	64.3	1.96	
New England	101[c]	39[c]	63.0[c]	0.10	
Oakdale	95	42	66.1	0.15	
Park River	88	37	64.4	2.08	
Pembina	86	42	64.0	5.86	
Portal	86	39	62.5	1.09	
Power	90	40	65.3	3.22	
Rolla	82	40	62.2	5.07	
Rugby	87	40	62.4	5.45	
University	87	40	63.7	2.01	
Wahpeton	88	46	66.6	3.70	
Walhalla	89	41	66.9	7.65	
Willow City	84	38	61.4	2.23	
Wishek	90	40	62.1	1.74	
Ohio.					
Akron	96	41	67.6	5.87	
Amesville	96	46	72.8	2.87	
Atwater	.....	.....	.....	3.65	
Bangorville	92	50	70.2	5.03	
Bellefontaine	91	48	70.0	3.78	
Benton Ridge	92	47	71.7	4.63	
Bladensburg	92	45	71.4	3.99	
Bowling Green	94	45	70.5	4.13	
Bucyrus	92	45	70.2	2.83	
Cadiz	92	49	71.0	7.25	
Cambridge	92	44	70.8	7.28	
Camp Dennison	98	49	74.0	1.86	
Canal Dover	93	46	70.8	5.31	
Canton	91	48	69.8	5.51	

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Ohio—Cont'd.	°	°	°	*Ins.*	*Ins.*
Cardington	94	44	70.0	3.00	
Circleville	97	49	73.2	2.36	
Clarington	94	49	73.0	3.96	
Clarksville	94	49	73.2	1.57	
Cleveland *a*	89	52	69.9	5.40	
Cleveland *b*	91	53	70.4	4.90	
Clifton	90	48	70.6	2.27	
Coalton	95	47	72.4	3.39	
Colebrook	.....	.....	.....	7.61	
Dayton *a*	.....	.....	.....	2.33	
Dayton *b*	95	48	73.6	3.04	
Defiance	94	46	70.4	2.41	
Delaware	93	46	70.8	5.16	
Demos	93	50	71.8	3.66	
Elyria	94	50	71.0	5.73	
Findlay	99	48	73.0	6.18	
Frankfort	96	49	74.8	1.23	
Fremont	92	49	71.3	8.09	
Garrettsville	92	45	67.9	4.68	
Granville	92	46	71.2	8.02	
Gratiot	90	46	70.8	9.57	
Green	95	50	74.2	2.10	
Greenfield	95	53	73.7	3.26	
Greenhill	90	44	68.2	3.63	
Greenville	96	47	72.7	2.74	
Hanging Rock	96	50	73.5	1.89	
Hedges	94	43	71.6	3.69	
Hillhouse	91	41	67.4	4.86	
Hiram	91	49	68.9	5.17	
Hudson	95	46	69.9	6.56	
Jacksonboro	98	50	74.1	2.06	
Kenton	92	53	73.4	4.34	
Killbuck	92[c]	47	69.8	5.76	
Lancaster	94	46	71.1	1.99	
Lima	92	51	71.4	5.43	
McConnelsville	94	46	71.1	1.29	
Manara	93	49	71.4	3.10	
Mansfield	.....	.....	.....	5.35	
Marietta	91	52	72.4	3.16	
Marion	94	47	71.6	3.40	
Medina	93	46	70.7	5.08	
Milfordton	93	45	70.2	4.67	
Milligan	94	43	70.3	3.31	
Millport	91	44	68.6	3.49	
Montpelier	93	46	70.6	3.62	
Napoleon	90	47	70.0	1.56	
Nellie	98	48	71.0	6.37	
New Alexandria	97	49	72.0	3.55	
New Berlin	93	47	70.0	3.70	
New Richmond	96	52	74.8	1.89	
New Waterford	94	45	70.2	3.70	
North Lewisburg	91	48	71.1	2.20	
North Royalton	93	46	69.4	6.29	
Norwalk	95	50	71.2	7.12	
Oberlin	92	47	69.7	6.76	
Ohio State University	92	48	70.8	3.13	
Orangeville	92	43	68.8	5.36	
Ottawa	95	47	71.8	5.70	
Pataskala	92	47	71.2	4.82	
Philo	94	48	72.8	3.25	
Plattsburg	90	47	70.8	2.89	
Pomeroy	95	50	73.0	2.22	
Portsmouth *a*	.....	.....	.....	2.97	
Portsmouth *b*	95	52	74.2	2.96	
Pulse	92	50	71.8	1.87	
Rittman	95	49	71.3	4.87	
Rockyridge	96	50[c]	72.8	3.09	
Shenandoah	91	50	69.1	5.84	
Sidney	94	50	72.8	3.42	
Somerset	99	52	73.3	4.38	
Springfield	.....	.....	.....	3.44	
Thurman	95	49	73.6	2.91	
Tiffin	92	51	70.9	7.73	
Toledo	94	51	72.3	2.31	
Upper Sandusky	93	50	71.6	4.33	
Urbana	92	49	71.0	2.58	
Vickery	94	46	71.0	5.92	
Warren	94	46	70.6	4.13	
Wauseon	96	44	70.1	3.76	
Waverly	96	48	73.6	3.43	
Waynesville	93	48	71.6	0.81	
Wellington	95	48	71.7	6.49	
Willoughby	.....	.....	.....	5.42	
Wilson	.....	.....	.....	3.00	
Wooster	92	46	69.8	4.93	
Zanesville	.....	.....	.....	7.34	
Oklahoma.					
Arapaho	98	57	79.0	5.78	
Beaver	99	52	78.0	5.35	
Binger	98	53	78.6	1.96	
Busch	99	54	78.6	1.58	
Chandler	99	58	80.7	1.70	
Cloud Chief	102	58	80.3	1.43	
Eldorado	103	60	82.4	0.87	
Enid	99	56	80.1	3.22	
Fort Reno	99	59	79.6	3.35	
Fort Sill	101	60	80.5	0.70	
Frederick	104	63	82.6	1.35	
Oklahoma—Cont'd.					
Gage	97	55	78.4	4.89	
Grand	.....	.....	.....	5.35	
Guthrie	93	62	78.8	4.08	
Harrington	97	57	77.0	2.66	
Hennessey	99[d]	61	80.8[e]	5.45	
Hobart	102	57	81.2	1.08	
Jefferson	100	58	79.4	5.36	
Jenkins	98	56	78.7	3.88	
Kenton	100	56	76.5	2.95	
Kingfisher	97	60	80.6	2.98	
McComb	97	57	79.2	2.94	
Mangum	102	61	83.2	0.70	
Newkirk	98	60	79.1	5.96	
Norman	100	55	81.0	2.29	
Pawhusha	98	51	77.6	10.25	
Perry	98	58	78.8	3.74	
Shawnee	96	60	79.0	1.66	
Stillwater	94	60	78.6	5.18	
Taloga	100	60	81.2	6.95	
Temple	103	58	83.9	1.28	
Waukomis	101	57	81.1	3.70	
Weatherford	96	57	78.2	6.68	
Whiteagle	95	60	79.4	10.05	
Woodward	100	58	89.4	7.31	
Oregon.					
Albany	.....	.....	.....	0.75	
Alpha	95	37	63.0	1.89	
Arlington	99	48	72.6	.....	
Ashland	99	41	68.0	1.11	
Astoria	81	47	60.8	1.99	
Aurora (near)	96	41	65.8	0.67	
Bay City	83	38	57.5	3.45	
Bend	94[c]	24	60.6[d]	1.32	
Beulah	98	32	65.6	0.54	
Blackbutte	97	40	66.2	1.90	
Bullrun	.....	.....	.....	1.19	
Burns	98	32	65.0	0.58	
Butter Creek	.....	.....	.....	0.66	
Cascade Locks	96	47	68.2	1.04	
Coquille	.....	.....	.....	1.69	
Corvallis	98	38	65.2	0.85	
Dayville	96	41	67.5	1.31	
Detroit	104	32	66.6	1.70	
Doraville	97	38	63.1	1.25	
Drain	100	36	65.4	1.40	
Ella	.....	.....	.....	0.18	
Fairview	86	37	60.6	1.47	
Falls City	96	36	63.5	1.55	
Forestgrove	100	35	65.4	0.53	
Gardiner	82	42	58.6	2.29	
Glendale	102[c]	39	68.7[d]	0.72	
Glenora	97	32	62.4	2.34	
Gold Beach	75	40	56.2	0.46	
Government Camp	84	32	54.8	1.78	
Grants Pass	107	40	69.4	0.34	
Grass Valley	97	33	62.8	0.09	
Heppner	95	40	66.6	2.95	
Hood River (near)	99	48	70.4	0.19	
Huntington	102	45	75.5	0.99	
Jacksonville	102	44	70.0	0.92	
Joseph	91	35	62.4	2.40	
Kerby	102	39	67.4	1.16	
Lagrande	99	39	67.6	1.48	
Lakeview	96	31	69.6	0.43	
Lonerock	95	36	63.4	2.46	
McKenzie Bridge	102	37	64.9	2.62	
McMinnville	97	34	66.3	0.53	
Meacham	.....	.....	.....	2.11	
Monroe	98	40	65.2	0.80	
Mount Angel	100	45	67.6	0.85	
Nehalem	.....	.....	.....	2.61	
Newport	67	42	55.1	2.24	
Ontario	.....	.....	.....	0.74	
Pendleton	107	39	71.8	2.47	
Pine	98	35	65.1	0.65	
Prineville	93	35	63.8	1.74	
Riverside	103	33	71.2	0.50	
Salem	96	44	66.8	0.80	
Silverlake	94	25	60.0	1.60	
Sparta	97	39	68.3	0.48	
Stafford	100	39	66.3	0.97	
The Dalles	100	46	71.5	0.40	
Toledo	86	36	58.6	1.83	
Umatilla	106	52	76.2	0.81	
Vale	100	35	68.4	1.24	
Wallowa	96	35	64.4	1.40	
Wamic	95	34	65.6	0.36	
Warm Spring	101	41	68.8	2.35	
Weston	97	36	66.2	2.78	
Williams	100	40	67.2	0.95	
Pennsylvania.					
Aleppo	91	43	70.2	3.38	
Altoona	94	45	70.0	4.68	
Beaver Dam	.....	.....	.....	5.49	
Bellefonte	96	47[b]	69.2[d]	5.18	
Brookville	.....	.....	.....	5.89	
Browers	.....	.....	.....	3.24	
California	95	47	72.6	2.63	
Pennsylvania—Cont'd.					
Cassandra	88	41	66.0	6.05	
Centerhall	91	45	68.4	5.72	
Clarion	.....	.....	.....	6.06	
Claysville	92	44	70.8	6.92	
Coatesville	96	51	73.4	3.91	
Coudersport	88	42	66.2	4.86	
Confluence	.....	.....	.....	2.34	
Davis Island Dam	.....	.....	.....	4.44	
Derry	94	42	70.6	6.21	
Doylestown	.....	.....	.....	9.19	
Dushore	92	41	67.4	2.98	
East Bloomsburg	.....	.....	.....	4.02	
East Mauch Chunk	96	45	71.6	7.06	
Easton	94	51	72.6	4.40	
Ellwood Junction	.....	.....	.....	3.00	
Emporium	91	46	70.2	5.46	
Ephrata	95	50	72.3	6.17	
Everett	91	45	70.0	5.69	
Forks of Neshaminy	.....	.....	.....	5.45	
Freeport	95[c]	47[c]	71.8[c]	4.26	
Gettysburg	93	54	73.0	4.46	
Girardville	.....	.....	.....	4.26	
Gordon	93	42	69.7	4.37	
Greensboro	.....	.....	.....	6.06	
Greenville	93	45	71.4	5.59	
Hamburg	98	49	73.9	5.63	
Hanover	96	49	73.6	3.47	
Herrs Island Dam	.....	.....	.....	3.78	
Huntingdon *a*	.....	.....	.....	6.81	
Huntingdon *b*	95	44	70.8	7.60	
Indiana	90	46	69.4	4.89	
Irwin	96	47	71.6	6.81	
Johnstown	95	44	71.9	7.45	
Keating	.....	.....	.....	3.42	
Kennett Square	92	53	73.2	3.28	
Lansdale	.....	.....	.....	1.92	
Lawrenceville	94	44	68.6	3.78	
Lebanon	96	49	72.3	5.89	
Leroy	90	47	68.0	2.21	
Lewisburg	95	46	71.8	3.61	
Lockhaven *a*	99	46	73.1	2.92	
Lockhaven *b*	.....	.....	.....	2.63	
Lock No. 4	.....	.....	.....	4.49	
Lycippus	89	49	70.6	5.95	
Marion	94	48	72.1	3.54	
Mifflin	.....	.....	.....	4.52	
Mifflintown	95	45	71.6	4.17	
Milford	95	45	69.4	3.53	
Montrose	89	44	67.0	4.70	
New Germantown	93	47	71.1	5.69	
Oil City	.....	.....	.....	3.42	
Ottsville	.....	.....	.....	5.37	
Parker	.....	.....	.....	3.72	
Philadelphia	96	58	74.9	3.43	
Pocono Lake	87	40	65.2	3.22	
Point Pleasant	.....	.....	.....	4.19	
Pottsville	.....	.....	.....	3.27	
Quakertown	94	48	72.0	5.68	
Reading	95	51	73.8	3.86	
Saegerstown	90	41	67.6	4.54	
St. Marys	87	45	66.6	3.82	
Saltsburg	.....	.....	.....	4.88	
Seisholtzville	.....	.....	.....	3.67	
Selinsgrove	97	49	73.5	5.04	
Shawmont	.....	.....	.....	2.11	
Skidmore	92	45	69.0	4.22	
Smethport	89	34	66.1	4.29	
Smiths Corners	.....	.....	.....	4.33	
Somerset	88	41	65.8	7.44	
South Eaton	90	42	69.0	5.94	
Springmount	.....	.....	.....	4.33	
State College	89	50	69.1	6.30	
Towanda	92	45	68.4	3.96	
Troutrun	.....	.....	.....	4.88	
Uniontown	92	47	71.2	3.29	
Warren	90	45	68.1	8.06	
Wellsboro	93	46	69.0	.....	
Westchester	93	54	73.2	3.65	
West Newton	.....	.....	.....	3.94	
Wilkesbarre	92	49	71.8	5.83	
Williamsport	93	51	71.5	5.59	
Rhode Island.					
Bristol	82	56	69.8	1.73	
Kingston	87	48	68.3	2.47	
Pawtucket	90	51	72.1	3.09	
Providence *a*	95	55	75.2	1.06	
Providence *c*	88	52	71.1	1.33	
South Carolina.					
Aiken	105	59	81.4	4.70	
Allendale	100	63	81.5	7.02	
Barksdale	101	58	79.8	9.51	
Batesburg	99	57	79.0	3.65	
Beaufort	94	66	80.0	6.67	
Bennettsville	96	65	79.8	7.46	
Blackville	104	61	81.6	1.67	
Bowman	102	61	80.0	4.01	
Calhoun Falls	.....	.....	.....	3.92	
Camden	.....	.....	.....	6.51	

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
South Carolina—Cont'd.	°	°	°	*Ins.*	*Ins.*
Cheraw *a*	95	62	77.8	14.38	
Cheraw *b*				12.02	
Clarks Hill	98	58	79.7	6.51	
Clemson College	101	54	77.4	1.44	
Conway	98	64	79.7	9.77	
Darlington	101	61	79.6	5.84	
Dillon	103	63	80.1	4.66	
Due West	96	60	79.4	2.00	
Edisto				5.27	
Effingham				3.81	
Florence	100	63	79.7	5.30	
Gaffney	105	56	80.1	3.04	
Georgetown [b]	95	68	79.3		
Gillisonville	102	63	79.8	4.28	
Greenville	97	54	74.6	2.15	
Greenwood	101	60	80.5	3.31	
Heath Springs	101	62	79.5	3.92	
Kingstree *a*	100	63	79.4	7.62	
Kingstree *b*				7.45	
Liberty	100	56	79.0	3.95	
Little Mountain	104	59	80.0	3.74	
Lugoff	104	57	79.2	9.42	
Newberry	102	58	80.8	5.96	
Pinopolis [1] [e]	94	66	77.5	8.15	
St. Georges	99	62	80.4	4.42	
St. Matthews	94	64	79.9	4.20	
St. Stephens				12.75	
Saluda	103	56	79.6	3.94	
Santuck	100	56	78.3	7.13	
Seivern	105	56	80.3	6.72	
Smiths Mills				8.20	
Society Hill	95	62	79.0	4.94	
Spartanburg	102	56	78.4	4.04	
Statesburg	100	60	80.3	1.75	
Summerville	100	64	79.3	8.44	
Sumter	105	60	81.8	3.28	
Trenton	102	63	80.4	4.71	
Trial	100	63	79.6	9.03	
Walhalla	101	50	75.5	4.95	
Walterboro	99	63	79.3	8.13	
Winnsboro	99	60	80.0	4.94	
Winthrop College	99	59	78.6	4.46	
Yemassee	100	63	80.0	8.81	
Yorkville	102	59	79.4	5.65	
South Dakota.					
Aberdeen	94	41	67.0	2.12	
Academy	100	46	71.6	2.27	
Alexandria	92	45	70.6	3.01	
Armour	102	43	69.8	2.88	
Ashcroft	98	43	66.6	1.52	
Bowdle	94	44	66.2	2.71	
Brookings	91	37	65.2	1.91	
Canton	93	43	68.7	4.58	
Cavite	98	47	71.2	4.05	
Centerville				3.52	
Chamberlain	102	49	72.8	1.78	
Cheyenne	99	46	71.6	2.33	
Clark	93	40	65.7	1.44	
Clear Lake	89	44	65.9	4.36	
DeSmet	91	40	66.4	2.74	
Doland	93°	40°	67.8°	2.23	
Elkpoint	96	45	71.5	2.43	
Fairfax	97	51	71.9	3.01	
Farmingdale				1.58	
Faulkton	93	44	66.8	1.42	
Flandreau	90	44	66.0	3.71	
Forestburg	94	42	69.2	4.47	
Fort Meade	100	49	69.6	0.40	
Gannvalley	101	45	70.6	6.13	
Grand River School	100	43	68.2		
Greenwood	94	50	71.8	4.92	
Herreid	96	42	68.0	1.80	
Highmore	98	46	69.8	2.40	
Hitchcock				1.31	
Hotch City	100	43	71.4	2.19	
Howard	91°	45°	69.1°	3.09	
Howell	97	40	69.1	2.60	
Ipswich	95	37	66.2	2.04	
Kidder	90	39	62.1	0.72	
Kimball	100			1.78	
Leola	90	40	65.1	2.27	
Leslie	102	45	72.2	2.64	
Marion	92[d]	47[d]	68.2[d]	6.16	
Mellette	97	41	67.5	1.65	
Menno	92	45	70.5	3.20	
Millbank	92	41	66.0	3.22	
Mitchell	96	44	69.8	3.56	
Oelrichs	101	41	70.6	1.30	
Pine Ridge				0.98	
Plankinton	98	43	69.2	3.61	
Ramsey	92	36	66.9	2.82	
Redfield	96	41	67.7	2.72	
Rosebud		41		5.39	
Silver City				1.37	
Sioux Falls	95	42	69.0	3.24	
Sisseton Agency	87	44	64.8	2.10	
Spearfish	91	46	65.4	2.08	
Stephan	98	42	69.6	4.18	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
South Dakota—Cont'd.	°		°	*Ins.*	*Ins.*
Tyndall	95	43	69.8	3.83	
Vermillion	97	46	72.2	1.97	
Watertown	89	43	64.4	5.08	
Wentworth	91	40	67.2	3.11	
Wolsey				3.04	
Tennessee.					
Andersonville	95	51	74.4	4.12	
Arlington	97	59	78.2	4.44	
Ashwood	95	55	75.4	3.31	
Benton	98	55	75.4	3.14	
Bluff City				3.13	
Bolivar	93	58	76.4	4.64	
Bristol	92	55	72.6	3.98	
Brownsville	93	60	77.8	4.16	
Byrdstown	91	53	73.6	2.59	
Carthage	96	57	75.1	3.08	
Cedar Hill	96	57	76.3	4.66	
Celina				2.20	
Charleston				2.84	
Clarksville	94	61	78.5	4.17	
Clinton				3.60	
Covington	93	60	77.3	5.89	
Decatur	98	53	75.6	2.56	
Dickson	96	51	75.1	1.67	
Dover	98	53	77.0	2.51	
Dyersburg	96	59	77.4	4.03	
Elizabethton	94	55	75.4	2.05	
Erasmus	92	45	70.2	2.60	
Florence	90	59	75.0	6.74	
Franklin	92	58	75.2	4.46	
Grace				2.40	
Greeneville	93	53	72.8	5.07	
Halls Hill				4.99	
Harriman	94	56	74.8	4.11	
Hohenwald	95	46	72.4	3.24	
Iron City	94	53	75.6	3.13	
Isabella	91	55	73.8	5.33	
Jackson	96	54	75.6	4.77	
Johnsonville	97	55	77.2	2.37	
Jonesboro	93	51	72.6	2.72	
Kenton	95	54	76.3	3.10	
Kingston				2.46	
Lafayette	95	53	74.6	3.48	
Leadvale				3.80	
Lebanon	93	55	76.0	3.58	
Loudon				4.75	
Lewisburg	98	55	77.2	2.50	
Liberty	97	53	78.0	3.19	
Lynnville	93	57	75.0	3.43	
McMinnville	94	54	74.2	3.61	
Maryville	100	54	75.8	5.86	
Milan	95	56	76.8	5.30	
Monterey	90	55	72.7	1.56	
Newport	92	55	74.6	5.67	
Palmetto	93	56	76.0	3.30	
Pope	99	52	77.6	3.03	
Rogersville	94	52	73.7	3.26	
Rugby	99	46	72.6	2.77	
Savannah	98	55	79.2	3.20	
Sewanee	90	57	73.0	1.21	
Silverlake	86	45	67.6	3.81	
Springdale	96	51	74.7	2.54	
Springville	96	51	75.9	1.66	
Tazewell				3.78	
Tellico Plains	97	56	76.4	4.89	
Tracy City	97	52	72.2	5.65	
Trenton	94	54	76.6	3.39	
Tullahoma	95	54	75.2	4.57	
Waynesboro	95	52	75.3	2.50	
Wildersville	88	57	74.8	5.82	
Yukon	95	59	76.1	4.46	
Texas.					
Albany	104	60	84.7	0.63	
Alvin				6.31	
Arthur				2.41	
Athens	104	65	82.8	2.58	
Austin	98	70	83.4	2.57	
Ballinger	101	64	82.0	1.09	
Beaumont	97	69	82.4	4.68	
Beeville	95	68	80.7	3.74	
Bigspring	99	60	81.2	0.75	
Blanco	96	60	78.6	2.21	
Boerne	96	63	78.6	1.99	
Bonham	101	63	82.2	2.11	
Booth				4.22	
Bowie	109	65	83.7	1.72	
Brazoria	92	68	79.8	3.08	
Brenham	95	69	80.8	4.86	
Brighton				2.58	
Brownwood	107	61	84.3	0.40	
Burnet	99	62	80.2	1.05	
Childress	101	62	81.7	2.40	
Clarendon	94			3.00	
Claytonville	100	61	81.0	1.01	
Coleman	97	65	80.4	2.35	
College Station	98°	68	82.9°	1.60	
Colorado	100	63	82.4	1.57	
Columbia	94	68	80.2	4.64	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Texas—Cont'd.	°	°	°	*Ins.*	*Ins.*
Columbus				3.40	
Comanche	104[k]	59[k]	81.6[k]	0.67	
Comstock	98	66	82.6	1.11	
Corsicana	102	67	83.6	2.53	
Cotulla	104	72	87.8	1.50	
Cuero	97	68	82.8	3.59	
Dallas	103	63	82.2	0.91	
Danevang	95	68	81.2	5.69	
Dialville	94	66	79.9	3.73	
Dublin	99	60	79.8	2.00	
Duval	94	67	80.4	1.88	
Eastland	105	61	82.8	2.79	
Estelle	105	63	82.3	0.52	
Fort Brown	94	69	82.0	4.59	
Fort Clark	99	67	82.3	1.65	
Fort Davis	94	55	74.0	1.53	
Fort McIntosh	101	70	85.4	1.21	
Fort Ringgold	99	69	84.2	5.40	
Fort Stockton	100	59	79.2	0.00	
Fredericksburg	101	65	81.7	2.44	
Gainesville	104°	62°	82.2°	1.02	
Gatesville	95	64	78.5	0.90	
Graham		53[k]	82.6	0.55	
Grapevine	106[f]	62[f]	82.4[f]	1.80	
Greenville	105	64	83.0	1.95	
Hale Center	95	61	76.9	2.75	
Hallettsville	94	70	81.6	4.98	
Haskell	103	65	85.6	0.51	
Hearne	99	61	80.6	2.23	
Hempstead				3.20	
Henrietta	105	64	83.4	0.50	
Hewitt				4.68	
Hillsboro	101	65	81.8	1.35	
Hondo	99	69	83.1	1.97	
Houston	99	68	81.6	7.31	
Huntsville	98	67	82.5	7.80	
Ira	98	61	80.2	0.74	
Jefferson	93	64	79.6	2.21	
Jewett	95	65	79.1	4.04	
Junction				3.89	
Kaufman	101	67	83.4	2.82	
Kent	99	55	78.0	0.11	
Kerrville	97	61	80.0	1.83	
Knickerbocker	101	61	81.4	0.81	
Kopperl				0.00	
Lampasas	99	63	80.2	2.56	
Lapara				4.90	
Laureles Ranch				1.08	
Liberty	97	65	83.6	2.50	
Llano				1.00	
Longview	101	61	82.7	4.67	
Luling	98	65	80.0	3.42	
McKinney	103	60	82.2	0.27	
Marlin	98	66	87.5	3.75	
Menardville	101[k]	59[k]	79.6[k]	2.88	
Midland	89	60	74.3	0.25	
Mount Blanco	99	60	79.0	0.09	
Nacogdoches	94	66	79.0	5.54	
New Braunfels	95	66	80.9	2.13	
Orange				3.20	
Panter				1.38	
Paris	100	62	81.6	1.95	
Pearsall	98	69	82.8	2.85	
Pierce	93	68	80.7	1.67	
Port Lavaca	92	69	80.5	3.85	
Rhineland	104	65	82.4	1.58	
Riverside				5.04	
Rockisland	91	67	79.3	4.81	
Rockland	99			6.22	
Rockport	90	71	80.2	3.15	
Runge	97	65	81.8	3.39	
Sabinal	96	64	80.6	4.17	
San Marcos	96	65	81.6	4.03	
San Saba	102	61	81.5	0.93	
Santa Gertrudes Ranch				3.86	
Sherman	98	68	83.2	2.79	
Sonora	99	60	79.3	1.18	
Sugarland	93	65	80.6	4.61	
Sulphur Springs	99	64	80.6	2.06	
Temple *b*	99	66	80.0	1.80	
Tilden	98	67	81.0	5.00	
Trinity	99	67	81.8	5.18	
Tulia	96	58	75.6	3.78	
Tyler	98	67	82.3	3.54	
Vernon	103°	62°	84.2°	1.11	
Victoria	94	68	80.8	2.01	
Waco	102	69	84.5	3.99	
Waxahachie	105	64	82.7	2.55	
Weatherford	105	67	84.0	1.22	
Wharton	96	66	80.8	5.00	
Wichita Falls				0.82	
Utah.					
Alpine				0.75	
Aneth	100	48	77.6		
Beaver				1.20	
Blackrock	92	39	67.0	0.05	
Blacksmith Fork				0.41	
Bluecreek				1.11	

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Utah—Cont'd.	°	°	°	*Ins.*	*Ins.*
Callao	97	36	70.3	T.	
Castledale	72	36	65.8	0.09	
Castle Rock				0.43	
Cisco	106	51	79.5	0.44	
Corinne	105	47	75.6	0.42	
Coyoto	84	30	56.0	0.11	
Emery	79	43	61.2	T.	
Escalante	98	41	70.2	0.86	
Experiment Farm	108	46	77.6		
Farmington	96	37	70.1	0.86	
Fillmore	105	49	76.2	0.07	
Fort Duchesne	97	43	70.5	0.37	
Frisco	99	50	71.9	0.86	
Garrison	100	42	71.1	0.93	
Giles	97	47	71.8	0.31	
Government Creek	96	40	71.2	0.41	
Green River	109	50	79.0	0.92	
Grover	86	39	62.2	0.39	
Heber	93	36	64.4	0.29	
Henefer	94	34	64.7	0.53	
Hite	105	60	83.7	0.15	
Huntsville				0.36	
Ibapah	94	32	65.0	0.15	
Kanab	97	39	67.4	2.50	
Kelton	98	42	70.6	2.00	
La Sal	87	47	63.5	0.82	
Levan	94	43	69.6	0.79	
Loa	100	38	67.4		
Logan	95	46	71.8	0.52	
Manti	95	43	68.4	0.61	
Marysvale	91	39	66.1	1.12	
Meadowville	87	36	63.0	0.50	
Millville				0.59	
Moab	103	47	77.4	0.37	
Monticello	91	44	67.4	1.32	
Morgan	91	34	64.8	0.86	
Mount Nebo	96	49	72.4	0.39	
Mount Pleasant	96	46	70.3	1.12	
Nephi				0.94	
Ogden	97	45	73.6	0.03	
Panquitch				1.79	
Parowan	101	43	70.2	0.98	
Payson				0.32	
Pine Valley				2.67	
Pinto	94	35	64.8	3.25	
Plateau	89	35	62.8	1.71	
Promontory *[1]	100	55	72.2	0.50	
Provo	96	44	69.8	0.39	
Ranch	92[f]	30[f]	59.6[f]	2.64	
Randolph				0.67	
Richfield	93[j]	41[j]	68.6[j]	0.27	
Rockwell	107	54	80.6	1.31	
St. George	107	47	77.8	0.59	
Salt Air	94	57	74.7	0.68	
Scipio	96	41	70.2	0.50	
Snowville	97	34	66.6	0.25	
Soldier Summit	88	30	60.0	0.55	
Terrace	102	40	72.0	0.30	
Thistle	105	40	71.0	0.32	
Tooele	94	49	71.8	0.55	
Tropic	93	39	66.6	0.92	
Wellington	97	42	69.7	0.15	
Woodruff	90	27	60.6	0.34	
Vermont.					
Burlington	89	53	69.0	4.19	
Cavendish	93	41	66.8	3.97	
Chelsea	87	42	65.2	3.56	
Chittenden				4.39	
Cornwall	92	48	66.6	5.05	
Derby	89	45	65.6	6.54	
Enosburg Falls	90	42	66.8	4.82	
Jacksonville	92	40	67.4	0.78	
Manchester	86	43	67.0	5.97	
Morrisville	91	42	67.8	3.87	
Norwich	93	37	66.3	2.96	
St. Johnsbury	92	44	68.8	2.81	
Wells	90	46	67.4	4.92	
Woodstock	94	42	67.3	3.39	
Virginia.					
Ashland	95	51	76.0	4.35	
Barboursville	93	54	73.6	4.45	
Bedford		52			
Bigstone Gap	91	51	71.8	3.19	
Blacksburg	91	40	69.4	4.13	
Buckingham	98	50	74.6	4.71	
Burkes Garden	85	38	64.4	3.72	
Callaville	96	57	77.6	5.44	
Charlottesville	99	59	75.1	4.54	
Clarksville				5.02	
Columbia	93	55	73.2	9.01	
Dale Enterprise	94	48	70.9	6.88	
Danville				4.86	
Elk Knob	88	55	71.0	4.16	
Farmville	98	56	78.0	3.14	
Fredericksburg	95	54	74.8	5.96	
Grahams Forge	88	47	68.8	3.62	
Hampton	94	64	77.2	7.07	
Hot Springs	88	45	67.5	2.02	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Virginia—Cont'd.	°	°	°	*Ins.*	*Ins.*
Ivanhoe				7.81	
Lexington	97	49	70.2	3.78	
Lincoln	94[g]	47[g]	73.5[g]	5.44	
Marion	90[e]	42[e]	70.0[e]	4.50	
McDowell	95	43	69.6	1.51	
Mendota				4.08	
Mount Weather	89	52	69.8	4.86	
Newport News	95	63	78.6	6.73	
Petersburg	98	60	77.1	5.85	
Radford				3.50	
Riverton				3.43	
Roanoke	98[e]	53[e]	74.8[e]	6.07	
Rockymount	87	55	70.8	6.18	
Saxe	97	54	75.9	3.82	
Shenandoah				6.38	
Speers Ferry				4.06	
Spottsville	98	55	75.9	6.07	
Staunton	95	50	72.5	4.40	
Stephens City	96	49	73.2	5.97	
Warsaw	97	57	77.5	3.90	
Wilkerson	96	56	76.0	5.60	
Woodstock				4.55	
Wytheville	93	46	71.2	1.82	
Washington.					
Aberdeen	99	40	60.3	1.70	
Anacrotes				0.23	
Bellingham	82	35	60.8	0.37	
Blaine	81	43	60.6	1.45	
Brinnon	92	47	62.8	2.45	
Cedonia	100	42	70.6	0.27	
Centralia	96	36	64.2	1.08	
Cheney	99	41	68.8	0.55	
Clearbrook	95	41	62.4	1.10	
Clearwater	88	40	59.8	4.33	
Cle Elum	96	38	63.2	0.49	
Colfax	95	37	65.5	1.00	
Colville	99	37	66.0	0.39	
Conconully	94	38	70.5	0.19	
Coupeville	88	42	61.2	0.35	
Crescent	99	37	67.7	0.22	
Cusick	98	35	66.2	0.84	
Danville	99	41	67.9	1.53	
Dayton	98	47	68.8	2.60	
East Sound	90	41	60.7	0.51	
Ellensburg	95	38	66.0	0.40	
Ephrata	103	42	75.4	0.75	
Grandmound	95	39	63.8	1.21	
Granite Falls				2.55	
Horseheaven				0.88	
Kennewick	105	46[e]	76.0[h]	0.33	
Lacenter	98	38	64.8	1.10	
Lakeside	98	55	74.2	T.	
Lester	96	42	62.8	0.98	
Lind	103	42	72.6	0.19	
Loomis	98	45	72.6	0.38	
Mottinger Ranch	103	52	74.3	0.91	
Mount Pleasant	97	39	65.6	1.11	
Moxee	99	40	69.4	1.74	
Northport	98	35	66.3	0.82	
Odessa	100	42	74.8	1.10	
Olga	81	46	60.8	0.40	
Olympia	98	36	64.6	1.79	
Pinehill	101	48	69.9	0.29	
Pomeroy	101	45	70.6	0.90	
Port Townsend	85	48	61.0	0.33	
Pullman	97[e]	44[g]	67.0[f]	1.22	
Rattlesnake	95	39	66.6	0.74	
Republic	96	38	64.8	0.98	
Ritzville				0.30	
Ritzville (near)				0.58	
Rosalia	95	41	66.2	1.15	
Sedro-Woolley	88	45	61.2	1.12	
Silvana	91	41	60.8	0.30	
Snohomish	89	46	63.6	1.06	
Snoqualmie	97	45	66.0	0.70	
Southbend	96	42	63.6	0.50	
South Ellensburg	98	42	68.0	0.25	
Sprague				0.70	
Sunnyside	96	41	70.0	1.01	
Trinidad	104	45	76.9	1.00	
Twisp	98	40	69.0	0.40	
Union	89	42	63.1	1.69	
Vancouver	99	44	68.0	0.51	
Vashon	88	45	62.9	1.05	
Wenatchee (near)	96	39	69.6	0.45	
Wilbur	95	38	65.2	0.68	
Zindel	108	52	76.2	4.03	
West Virginia.					
Bancroft	96	53	73.3	2.17	
Bens Run	96	51	72.9	2.57	
Berkeley Springs	92[e]	48[e]	73.1[e]	4.58	
Beverly	93	47	69.2	3.34	
Bluefield	89	54	71.0		
Buckhannon				5.98	
Burlington	93	46	70.6	3.70	
Cairo	94	46	71.5	2.27	
Central	93	45	70.8	2.78	
Chapel	96			1.01	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
West Virginia—Cont'd.	°	°	°	*Ins.*	*Ins.*
Charleston	94	54	75.0	3.28	
Creston	100	44	72.0	1.12	
Cuba	93	48	71.4	1.95	
Doane	93	47	72.9	1.45	
Elkhorn	90	47	70.8	4.13	
Fairmont				2.89	
Grafton	92	46	70.6	1.60	
Green Sulphur Springs	91	43	69.0	1.38	
Harpers Ferry				4.92	
Hinton				2.41	
Huntington	96	55	75.0	2.50	
Leonard	83	45	70.2	1.04	
Lewisburg	91	46	69.4	2.75	
Lillydale	91	45	70.6	3.57	
Logan	92	53	73.1	3.73	
Mannington	94	45	71.2	2.57	
Martinsburg	97	49	73.6	5.61	
Moorefield	96	45	72.2	5.17	
Morgantown	89	47	71.0	4.50	
Moundsville	91	50	71.2	4.74	
New Cumberland	90	48	69.6	4.18	
New Martinsville	96	50	74.3	3.45	
Nuttallburg	92	43	70.4	1.05	
Parsons	89	46	68.6	1.83	
Philippi	93	45	70.4	3.61	
Pickens	86[e]	45[e]	67.0[e]	4.70	
Point Pleasant	96	50	74.8	2.46	
Powellton	96	52	75.6	2.48	
Princeton	86	46	69.4	2.60	
Rowlesburg				4.60	
Ryan	94	49	71.6	1.94	
Southside	94	56	74.6	3.03	
Terra Alta	90	42	68.2	5.50	
Uppertract	92	43	71.1	6.00	
Valley Fork	91	50	72.0	5.32	
Wellsburg	88	50	69.8	5.92	
Weston *b*	93	50	76.6	1.85	
Wheeling *a*				5.63	
Wheeling *b*	102	60	79.8	5.81	
Williamson	94	54	74.9	2.07	
Wisconsin.					
Amherst	92	43	67.0	3.87	
Antigo	94	41	64.4	5.18	
Appleton	90	46	67.9	7.06	
Appleton Marsh	93	41	64.2	1.81	
Ashland				3.43	
Barron	92	40	66.8	6.15	
Beloit	95	45	72.4	1.99	
Berlin	95	46	68.6	8.63	
Brodhead	99	40	71.0	3.12	
Burnett	94	44	67.8	3.55	
Butternut	93	36	63.2	2.88	
Chilton	95	46	68.8	3.76	
Chippewa Falls				0.30	
Citypoint	94	31	62.7	0.94	
Darlington	103	40	70.6	3.70	
Dodgeville	94	44	67.3	2.26	
Downing	90	40	63.6	6.50	
Easton	95	40	66.4	5.65	
Eau Claire	92	46	67.7	2.42	
Florence	90	40	63.8	2.97	
Fond du Lac	96	43	68.6	4.47	
Grand Rapids	93	42	67.2	1.83	
Grand River Locks				6.29	
Grantsburg	93	42	65.0	4.76	
Hancock	93	45	67.6	4.00	
Hayward	92	36	63.7	3.45	
Hillsboro	94	39	66.6	4.41	
Koepenick	92	35	65.2	4.00	
Lake Mills	97	47	69.2	3.80	
Lancaster	94	44	68.2	4.63	
Madison	90	50	69.4	3.27	
Manitowoc	93	48	66.6	2.52	
Meadow Valley	94	41	66.3	1.52	
Medford	94	40	66.8	2.85	
Menasha				3.34	
Minocqua	90	45	66.6	2.59	
Mount Horeb	95	43	68.4	3.22	
Neillsville	96	41	67.0	2.37	
New London	94	45	68.1	3.22	
Oconto	93	44	67.0	3.26	
Osceola	92	42	65.9	5.05	
Oshkosh	94[d]		72.0	3.56	
Pine River	92	46	67.4	4.03	
Portage	92	49	68.7	3.63	
Port Washington	93	42	65.0	2.06	
Prairie du Chien *a*	98	45	71.0	3.14	
Prairie du Chien *b*				3.22	
Prentice	90	37	63.2	2.21	
Racine	98	49	70.0	3.35	
Sheboygan	97	49	66.6	2.37	
Stanley	92	39	64.2	1.98	
Stevens Point	93	41	66.7	2.98	
Tomahawk	92	40	64.0	2.40	
Valley Junction	96	42	67.4	3.66	
Viroqua	90	48	68.0	4.65	
Washburn	95	43	69.6	2.40	
Watertown	94	44	67.8	2.87	

TABLE II.—*Climatological record of voluntary and other cooperating observers. Late reports for June*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Wisconsin—Cont'd.	°	°	°	*Ins.*	*Ins.*
Waukesha	93	48	69.1	3.17	
Waupaca	94	44	67.2	3.32	
Wausau	92	37	63.7	3.57	
Whitehall	92	40	66.0	2.93	
Wyoming.					
Afton	88	39	60.4	0.60	
Alcova	95	42	68.8	0.36	
Basin	96	42	72.2	0.83	
Bedford	85	28	57.7	0.66	
Border	90	27	60.6	0.12	
Buffalo	91	36	64.0	0.70	
Cambria	92	44	67.3	1.34	
Chugwater	89[b]	32[b]	63.2[b]	1.13	
Daniel	84	27	57.3	1.16	
Embar	93	40	65.0	1.13	
Evanston	86	33	59.8	0.47	
Fort Laramie	99	.....	70.6[d]	1.09	
Fort Washakie	91	37	65.4	1.97	
Freedom	88	25	58.5	0.27	
Gillette	98	40	67.2	1.04	
Griggs	93	35	64.8	0.77	
Hyattville	97	40	69.4	.....	
Iron Mountain	88	32	61.1	1.54	
Kimball Ranch	90	40	65.1	0.42	
Kirtley	94	32	63.2	1.65	
Laramie	83	32	60.6	1.33	
Leo	86	31	62.3	0.37	
Lolabama Ranch	82	31	55.6	1.33	
Lusk	96	30	65.9	0.34	
Marquette	90	41	64.0	0.98	
Moore	93	34	61.7	1.78	
Moorcroft	96	40	68.2	0.62	
Phillips	92	34	64.0	2.31	
Pine Bluff	93	40	66.0	1.57	
Rawlins	98	39	69.0	1.28	
South Pass	88	26	57.6	0.36	
Story	.....	.....	.....	2.00	
Thermopolis	94	39	65.5	1.43	
Wells	80	25	53.2	1.48	
Yellowstone Park (G. C.)	.....	.....	.....	4.30	
Yellowstone Pk. (Foun'n)	83	28	54.2	2.03	
Yellowstone Pk. (Lake)	85	29	56.1	2.56	
Yellowstone Park (Norris)	86	.....	.....	1.79	
Yellowstone Pk. (U. Ba'n)	82	28	54.6	1.55	
Porto Rico.					
Adjuntas	89	56	72.4	3.69	
Aguirre	90	70	80.2	3.62	
Arecibo	88	60	75.1	2.77	
Bayamon	91	60	78.0	.....	
Caguas	90	60	77.2	3.98	
Canovanas	89	73	80.4	2.42	
Cayey	98	67	82.6	8.34	
Cidra	92	59	76.4	12.29	
Coamo	94	68	80.6	2.18	
Fajardo	92	70	81.6	4.41	
Guanica	90	65	78.0	0.96	
Hacienda Colosa	94	64	79.0	4.14	
Hacienda Josefa	....	.....	.....	4.71	
Hacienda Perla	90	70	80.0	9.26	
Humacao	89	76	83.2	5.13	
Isabela	91	66	79.4	1.97	
Porto Rico—Cont'd.	°	°	°	*Ins.*	*Ins.*
Juana Diaz	91	61	77.1	2.45	
La Carmelita	89	65	76.3	5.20	
La Isolina	93	66	78.6	4.78	
Lares	92	59	75.8	4.70	
Las Marias	91	65	77.9	5.55	
Manati	96	66	79.6	4.87	
Maunabo	93	70	81.7	7.54	
Mayaguez	94	64	78.4	16.07	
Morovis	93	62	77.0	7.10	
San German	98	59	79.4	3.45	
San Lorenzo	92	65	78.2	6.69	
San Salvador	90	63	78.4	5.07	
Santa Isabel	90	68	79.1	1.28	
Vieques	91[b]	67[b]	81.9[b]	2.10	
Yauco	89	69	79.8	3.41	
Mexico.					
Leon de Aldamas	85	53	67.9	7.10	
New Brunswick.					
St. John	80	51	61.2	2.81	

Late reports for June, 1904.

Alaska.					
Coal Harbor	61	35	44.9	1.23	
Copper Center	76	32	52.0	1.11	
Coldfoot	83	29	54.2	1.25	
Fort Gibbon	85	39	62.6	0.33	
Fort Liscum	61	36	48.2	2.26	
Fort Yukon	83[e]	28	56.8[e]	0.24	
Juneau	68	31	50.6	10.40	
Kenai	65	29	48.4	0.87	
Ketchikan	71	27	48.2	0.83	
Mine Harbor	58	31	43.4	1.30	
Skagway	70	33	51.8	0.97	
Sunrise	68	31	49.0	1.36	
Teikhill	.....	28	.....	0.79	
Wood Island	68	36	50.4	2.26	
California.					
Folsom	.....	.....	.....	T.	
Newcastle	107	43	76.6	0.00	
Colorado.					
Fowler	.....	.....	.....	2.35	
Florida.					
Clermont	102	67	81.8	12.73	
Indian Territory.					
Goodwater	93	60	76.4	11.37	
Marlow	95	56	74.8	14.36	
Iowa.					
Fayette	88[a]	40[f]	65.3[a]	2.02	
Kansas.					
Madison	91	52	70.7	8.91	
Toronto	90	52	70.4	14.11	
Gates Center	90	52	70.9	12.68	
Mississippi.					
Canton	99	54	79.0	3.52	
Louisville	97	55	78.4	4.55	
Magnolia	99	60	79.6	8.09	
Nebraska.					
Ansley	.....	42	.....	3.95	
New York.	°	°	°	*Ins.*	*Ins.*
Rome	.....	.....	.....	3.88	
Oregon.					
Beulah	88	24	54.8	0.00	
South Dakota.					
Pedro	95	40	65.6	2.63	
Texas.					
Eastland	101	58	78.6	1.62	
Vermont.					
Chittenden	.....	.....	.....	1.96	
Virginia.					
Mount Weather	88	45	67.0	8.64	
Washington.					
Anacortez	.....	.....	.....	1.69	
Wyoming.					
Kimball Ranch	88[f]	35[f]	60.4[f]	0.11	
Porto Rico.					
Guanica	91	67	79.0	.....	
Mexico.					
Coatzacoalcos	97	67	78.8	9.22	
Leon de Aldemas	90	55	70.0	3.65	
Vera Cruz	91	63	79.6	14.73	

EXPLANATION OF SIGNS.

• Extremes of temperature from observed readings of dry thermometer.

A numerical following the name of a station indicates the hours of observation from which the mean temperature was obtained, thus:

[1] Mean of 7 a. m. + 2 p. m. + 9 p. m. + 9 p. m. + 4.
[2] Mean of 8 a. m. + 8 p. m. + 2.
[3] Mean of 7 a. m. + 7 p. m. + 2.
[4] Mean of 6 a. m. + 6 p. m. + 2.
[5] Mean of 7 a. m. + 2 p. m. + 2.
[6] Mean of readings at various hours reduced to true daily mean by special tables.

The absence of a numeral indicates that the mean temperature has been obtained from daily readings of the maximum and minimum thermometers.

An italic letter following the name of a station, as "Livingston *a*," "Livingston *b*," indicates that two or more observers, as the case may be, are reporting from the same station. A small roman letter following the name of a station, or in figure columns, indicates the number of days missing from the record; for instance, "a" denotes 14 days missing.

No note is made of breaks in the continuity of temperature records when the same do not exceed two days. All known breaks of whatever duration, in the precipitation record receive appropriate notice.

CORRECTIONS.

April, 1904, California, Lick Observatory, make precipitation read 4.38 instead of 4.21.

Florida, Lake City, make mean temperature read 66.9° instead of 66.0°.

NOTE.—The following changes have been made in the names of stations: Nebraska, Crook changed to Burge.

TABLE VI.—*Data furnished by the Canadian Meteorological Service, July, 1904.*

Stations.	Pressure, in inches. Actual, reduced to mean of 24 hours.	Sea level, reduced to mean of 24 hours.	Departure from normal.	Temperature. Mean.	Departure from normal.	Mean maximum.	Mean minimum.	Precipitation. Total.	Departure from normal.	Depth of snow.
	Ins.	*Ins.*	*Ins.*	°	°	°	°	*Ins.*	*Ins.*	*Ins.*
St. Johns, N. F	29.81	29.94	—.03	63.1	+ 3.8	72.6	53.5	2.73	—1.16	
Sydney, C. B. I	29.97	30.01	+.08	67.3	+ 5.0	77.7	56.8	3.47	—0.18	
Halifax, N. S	29.91	30.01	+.05	67.1	+ 3.7	77.0	57.2	2.32	—1.73	
Grand Manan, N. B	29.90	29.95	+.02	62.2	+ 0.5	69.7	54.7	3.34	+0.34	
Yarmouth, N. S	29.94	30.01	+.06	63.2	+ 3.7	68.7	57.6	2.53	—1.09	
Charlottetown, P. E. I	29.91	29.95	+.05	68.6	+ 4.5	77.2	60.1	1.90	—1.59	
Chatham, N. B	29.86	29.88	.00	69.8	+ 4.8	81.4	58.3	2.76	—1.43	
Father Point, Que	29.83	29.85	.00	60.2	+ 2.6	68.9	51.4	2.20	—0.84	
Quebec, Que	29.60	29.92	+.01	67.7	+ 2.1	77.2	58.1	4.33	+0.07	
Montreal, Que	29.73	29.93	.00	68.8	+ 0.3	76.5	61.1	2.95	—1.34	
Rockliffe	29.43	29.96	+.02	64.5	— 1.1	76.1	52.8	3.07	—0.05	
Ottawa, Ont	29.59	29.91	—.03	68.3	— 1.2	77.7	58.9	3.71	+0.24	
Kingston, Ont	29.65	29.95	—.02	65.7	— 2.5	72.9	58.6	3.51	+0.62	
Toronto, Ont	29.60	29.96	—.01	67.5	— 0.5	77.6	57.4	5.15	+2.23	
White River, Ont	28.61	29.90	—.04	58.0	— 1.5	71.3	44.8	2.52	—0.28	
Port Stanley, Ont	29.36	29.99	+.01	66.8	— 1.0	76.2	57.4	3.38	+0.34	
Saugeen, Ont	29.28	29.98	+.01	64.8	+ 0.1	74.3	55.3	1.60	—0.38	
Parry Sound, Ont	29.23	29.96	.00	65.6	— 0.4	76.1	55.1	3.82	+1.20	
Port Arthur, Ont	29.22	29.93	—.01	60.4	— 1.6	71.4	49.4	2.94	—0.54	
Winnipeg, Man	29.06	29.88	—.05	63.3	— 2.7	74.4	52.2	5.55	+2.47	
Minnedosa, Man	28.10	29.89	—.04	60.8	— 1.4	73.5	48.1	2.74	+0.14	
Qu'Appelle, Assin	27.66	29.87	—.05	62.3	— 1.2	75.4	49.3	3.78	+1.30	
Medicine Hat, Assin	27.61	29.83	—.07	70.4	+ 2.6	86.3	54.5	1.19	—0.90	
Swift Current, Assin	27.38	29.90	—.01	65.0	— 1.5	80.0	50.1	2.34	—0.10	
Calgary, Alberta	26.39	29.86	—.04	60.9	+ 0.3	77.0	44.9	1.80	—0.88	
Banff, Alberta	25.40	29.90	.00	59.3	+ 2.7	75.6	42.9	0.87	—2.37	
Edmonton, Alberta	.....	.....	.....	.....	.....	.....	.....	.....	.....	
Prince Albert, Sask	28.25	29.78	—.13	60.6	— 1.3	71.8	49.5	3.19	+1.14	
Battleford, Sask	28.17	29.89	—.01	62.7	— 2.0	75.6	49.8	1.69	—0.65	
Kamloops, B. C	28.67	29.86	—.08	70.1	+ 1.6	84.9	55.3	1.02	—0.59	
Victoria, B. C	29.92	30.01	—.04	60.8	+ 0.8	68.9	52.7	0.48	+0.08	
Barkerville, B. C	.....	.....	.....	.....	.....	.....	.....	.....	.....	
Hamilton, Bermuda	29.71	29.98	+.07	73.5	— 1.6	67.6	39.5	2.13	—0.89	
Dawson, Yukon	.....	.....	.....	.....	.....	.....	.....	.....	.....	

TABLE III.—*Resultant winds from observations at 8 a. m. and 8 p. m., daily, during the month of July, 1904.*

Stations.	Component direction from—				Resultant.	
	N.	S.	E.	W.	Direction from—	Duration.
New England.	*Hours.*	*Hours.*	*Hours.*	*Hours.*	°	*Hours.*
Eastport, Me	10	37	5	22	s. 33 w.	32
Portland, Me	8	33	11	19	s. 18 w.	26
Concord, N. H.†	11	9	7	10	n. 56 w.	4
Northfield, Vt	14	33	7	15	s. 23 w.	21
Boston, Mass	12	27	13	21	s. 28 w.	17
Nantucket, Mass	8	35	11	20	s. 18 w.	28
Block Island, R. I	10	30	10	27	s. 40 w.	26
Narragansett, R. I.*	1	5	8	11	s. 12 w.	14
New Haven, Conn	19	27	11	18	s. 41 w.	11
Middle Atlantic States.						
Albany, N. Y	20	28	8	15	s. 41 w.	11
Binghamton, N. Y.†	7	6	14	9	s. 79 e.	5
New York, N. Y	16	22	13	22	s. 56 w.	11
Harrisburg, Pa	8	19	17	27	s. 42 w.	15
Philadelphia, Pa	19	23	12	25	s. 73 w.	14
Scranton, Pa	19	18	17	23	n. 80 w.	6
Atlantic City, N. J	16	23	9	28	s. 70 w.	20
Cape May, N. J	14	29	13	17	s. 15 w.	16
Baltimore, Md	21	18	8	27	n. 81 w.	19
Washington, D. C	20	23	17	16	s. 18 e.	3
Cape Henry, Va.†	6	18	10	7	s. 14 e.	12
Lynchburg, Va	18	17	17	25	n. 83 w.	8
Norfolk, Va	12	33	13	16	s. 8 w.	21
Richmond, Va	18	27	10	22	s. 13 w.	9
Wytheville, Va	13	17	9	37	s. 82 w.	28
South Atlantic States.						
Asheville, N. C	25	22	9	18	n. 72 w.	10
Charlotte, N. C	13	28	17	20	s. 11 w.	15
Hatteras, N. C	8	29	7	36	s. 54 w.	36
Kittyhawk, N. C.*						
Raleigh, N. C	14	29	14	22	s. 28 w.	17
Wilmington, N. C	8	28	4	36	s. 58 w.	38
Charleston, S. C	5	34	4	29	s. 41 w.	38
Columbia, S. C	8	31	18	21	s. 7 w.	23
Augusta, Ga	8	37	13	19	s. 12 w.	30
Savannah, Ga	5	35	3	34	s. 46 w.	43
Jacksonville, Fla	5	41	16	20	s. 6 w.	36
Florida Peninsula.						
Jupiter, Fla	12	36	20	11	s. 21 e.	26
Key West, Fla	2	17	51	0	s. 74 e.	53
Sand Key, Fla.†	1	7	26	0	s. 77 e.	27
Tampa, Fla	15	20	28	13	s. 72 e.	16
Eastern Gulf States.						
Atlanta, Ga	23	11	16	26	n. 40 w.	16
Macon, Ga.†	6	15	4	14	s. 48 w.	14
Pensacola, Fla.†	12	5	9	12	n. 23 w.	8
Birmingham, Ala.†	7	11	9	10	s. 14 w.	4
Mobile, Ala	12	26	9	26	s. 51 w.	22
Montgomery, Ala	7	27	10	33	s. 49 w.	30
Meridian, Miss.†	4	18	4	16	s. 41 w.	18
Vicksburg, Miss	12	34	19	12	s. 18 e.	23
New Orleans, La	6	38	10	22	s. 21 w.	34
Western Gulf States.						
Shreveport, La	6	32	30	9	s. 39 e.	33
Fort Smith, Ark	6	16	42	6	s. 74 e.	37
Little Rock, Ark	13	31	13	21	s. 24 w.	20
Corpus Christi, Tex	0	42	35	1	s. 39 e.	54
Fort Worth, Tex	4	47	17	5	s. 15 e.	45
Galveston, Tex	4	45	13	14	s. 1 w.	40
Palestine, Tex	0	50	11	13	s. 2 w.	50
San Antonio, Tex	2	39	41	1	s. 47 e.	54
Taylor, Tex.†	1	26	6	1	s. 11 e.	26
Ohio Valley and Tennessee.						
Chattanooga, Tenn	14	19	5	33	s. 80 w.	28
Knoxville, Tenn	19	22	11	25	s. 78 w.	14
Memphis, Tenn	12	30	16	16	s.	18
Nashville, Tenn	17	24	11	26	s. 65 w.	17
Lexington, Ky.†	4	18	5	11	s. 23 w.	15
Louisville, Ky	21	24	7	23	s. 79 w.	16
Evansville, Ind.†	8	12	4	14	s. 68 w.	11
Indianapolis, Ind	16	28	8	21	s. 47 w.	18
Cincinnati, Ohio	17	21	12	26	s. 74 w.	15
Columbus, Ohio	16	24	12	26	s. 60 w.	16
Pittsburg, Pa	22	21	6	30	n. 88 w.	24
Parkersburg, W. Va	17	28	9	20	s. 45 w.	16
Elkins, W. Va	24	16	6	28	n. 70 w.	23
Lower Lake Region.						
Buffalo, N. Y	13	26	10	30	s. 57 w.	24
Oswego, N. Y	9	31	11	22	s. 26 w.	25
Rochester, N. Y	15	18	10	33	s. 83 w.	23
Syracuse, N. Y	7	30	10	24	s. 31 w.	27
Erie, Pa	14	20	14	25	s. 61 w.	12
Cleveland, Ohio	16	31	13	15	s. 8 w.	15
Sandusky, Ohio†	5	12	3	16	s. 62 w.	15
Toledo, Ohio	12	22	10	32	s. 66 w.	24
Detroit, Mich	19	19	13	26	w.	13
Upper Lake Region.						
Alpena, Mich	22	15	15	26	n. 58 w.	13
Escanaba, Mich	22	24	10	18	s. 76 w.	8
Grand Rapids, Mich	17	24	10	29	s. 70 w.	20
Houghton, Mich.†	1	5	9	18	s. 66 w.	10
Marquette, Mich	18	18	16	22	w.	6
Port Huron, Mich	20	21	12	22	s. 84 w.	10
Sault Ste. Marie, Mich	16	11	17	32	n. 72 w.	16
Chicago, Ill	19	25	16	20	s. 34 w.	7
Milwaukee, Wis	17	19	9	25	s. 83 w.	16
Green Bay, Wis	14	28	12	25	s. 43 w.	19
Duluth, Minn	23	9	20	26	n. 23 w.	15
North Dakota.						
Moorhead, Minn	9	20	20	20	s.	11
Bismarck, N. Dak	27	14	22	14	n. 32 e.	15
North Dakota—Continued.						
Williston, N. Dak	20	17	20	16	n. 53 e.	5
Upper Mississippi Valley.						
Minneapolis, Minn.*	7	9	7	13	s. 72 w.	6
St. Paul, Minn	20	20	15	19	w.	4
La Crosse, Wis.†	10	17	2	7	s. 36 w.	9
Davenport, Iowa	18	23	12	24	s. 67 w.	13
Des Moines, Iowa	16	26	16	19	s. 17 w.	10
Dubuque, Iowa	21	23	6	27	s. 85 w.	21
Keokuk, Iowa	19	27	9	25	s. 63 w.	18
Cairo, Ill	18	29	9	19	s. 42 w.	15
Springfield, Ill	13	30	11	22	s. 33 w.	20
Hannibal, Mo.†	7	12	6	15	s. 61 w.	10
St. Louis, Mo	16	31	12	14	s. 8 w.	15
Missouri Valley.						
Columbia, Mo.*	8	13	9	8	s. 11 e.	5
Kansas City, Mo	18	30	24	10	s. 63 e.	16
Springfield, Mo	11	32	19	13	s. 16 e.	22
Topeka, Kans.*	5	16	13	4	s. 39 e.	14
Lincoln, Nebr	18	27	23	10	s. 55 e.	16
Omaha, Nebr	17	29	19	11	s. 34 e.	14
Valentine, Nebr	14	21	23	15	s. 49 e.	11
Sioux City, Iowa†	11	12	12	5	s. 82 e.	7
Pierre, S. Dak	16	19	23	20	s. 45 e.	4
Huron, S. Dak	24	17	24	12	n. 60 e.	14
Yankton, S. Dak.†	4	12	11	9	s. 14 e.	8
Northern Slope.						
Havre, Mont	21	15	22	20	n. 18 e.	6
Miles City, Mont	18	17	17	26	n. 84 w.	9
Helena, Mont	11	20	7	37	s. 73 w.	31
Kalispell, Mont	5	10	13	43	s. 81 w.	30
Rapid City, S. Dak	14	22	19	21	s. 14 w.	8
Cheyenne, Wyo	22	21	7	26	n. 87 w.	19
Lander, Wyo	19	22	10	27	s. 80 w.	17
Yellowstone Park, Wyo	18	23	26	11	s. 72 e.	16
North Platte, Nebr						
Middle Slope.						
Denver, Colo	14	30	10	18	s. 27 w.	18
Pueblo, Colo	29	10	21	15	n. 18 e.	20
Concordia, Kans	10	35	20	10	s. 22 e.	27
Dodge, Kans	7	35	29	7	s. 38 e.	36
Wichita, Kans	10	32	28	3	s. 47 e.	33
Oklahoma, Okla	7	43	22	4	s. 27 e.	40
Southern Slope.						
Abilene, Tex	4	45	25	8	s. 22 e.	44
Amarillo, Tex	4	38	28	7	s. 32 e.	40
Southern Plateau.						
El Paso, Tex	16	16	37	9	e.	28
Santa Fe, N. Mex	13	23	29	13	s. 58 e.	19
Flagstaff, Ariz	20	18	4	33	n. 86 w.	29
Phoenix, Ariz	10	12	28	26	s. 45 e.	3
Yuma, Ariz	3	35	15	26	s. 19 w.	34
Independence, Cal	22	21	14	21	n. 82 w.	7
Middle Plateau.						
Carson City, Nev	7	20	5	38	s. 69 w.	36
Winnemucca, Nev	23	13	20	25	n. 27 w.	11
Modena, Utah	9	18	8	40	s. 74 w.	33
Salt Lake City, Utah	23	18	21	16	n. 45 e.	7
Grand Junction, Colo	10	19	30	17	s. 55 e.	16
Northern Plateau.						
Baker City, Oreg	25	23	14	20	n. 72 w.	6
Boise, Idaho	21	17	8	30	n. 80 w.	22
Lewiston, Idaho†	2	5	24	3	s. 82 e.	21
Pocatello, Idaho	4	16	33	19	s. 49 e.	18
Spokane, Wash	11	30	16	14	s. 6 e.	19
Walla Walla, Wash	9	35	19	13	s. 13 e.	27
North Pacific Coast Region.						
North Head, Wash	33	12	3	32	n. 54 w.	36
Port Crescent, Wash.*	8	3	3	23	n. 76 w.	21
Seattle, Wash	19	21	8	23	s. 82 w.	15
Tacoma, Wash	25	14	2	29	n. 68 w.	29
Tatoosh Island, Wash	14	25	11	30	s. 60 w.	22
Portland, Oreg	31	10	11	30	n. 42 w.	28
Roseburg, Oreg	33	2	20	15	n. 9 e.	31
Middle Pacific Coast Region.						
Eureka, Cal	33	14	3	24	n. 48 w.	28
Mount Tamalpais, Cal	26	5	2	46	n. 64 w.	49
Red Bluff, Cal	17	30	27	11	s. 51 e.	21
Sacramento, Cal	2	51	16	5	s. 13 e.	50
San Francisco, Cal	0	15	1	54	s. 74 w.	55
Point Reyes Light, Cal.*	18	3	1	20	n. 52 w.	24
Southeast Farallon, Cal.*	18	4	0	21	n. 56 w.	25
South Pacific Coast Region.						
Fresno, Cal	40	2	0	40	n. 46 w.	55
Los Angeles, Cal	2	18	10	40	s. 62 w.	34
San Diego, Cal	19	17	2	40	n. 87 w.	38
San Luis Obispo, Cal	23	14	5	34	n. 73 w.	30
West Indies						
Basseterre, St. Kitts, W. I						
Bridgetown, Barbados	8	3	50	0	n. 84 e.	50
Cienfuegos, Cuba	33	4	41	2	n. 53 e.	49
Colon, Panama, S. A.†	6	18	8	6	s. 9 e.	12
Curaçoa, W. I						
Grand Turk, W. I.†	0	1	31	0	s. 88 e.	31
Hamilton, Bermuda						
Havana, Cuba†	1	1	30	0	e.	30
Kingston, Jamaica	20	2	6	9	n. 9 w.	18
Port of Spain, Trinidad†						
Puerto Principe, Cuba	17	5	50	1	n. 76 e.	50
Roseau, Dominica, W. I.†	13	5	19	4	n. 62 e.	17
San Juan, Porto Rico	1	5	58	0	s. 86 e.	58
Santiago de Cuba, Cuba						

* From observations at 8 p. m. only. † From observations at 8 a. m. only.

TABLE IV.—*Thunderstorms and auroras, July, 1904.*

States.	No. of stations.		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total. No.	Total. Days.	
Alabama	60	T.	6	11	9	11	13	13	10	9	12	6	7	15	6	5	4	7	8	13	7	14	18	21	8	1	....	5	11	4	4	9	11	278	30	T.
		A.	....	....	....	....	....	....	....	1	....	....	....	....	....	3	4	2	2	....	4	10	14	12	11	11	17	15	10	11	15	10	7	159	18	A.
Arizona	56	T.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Arkansas	57	T.	4	15	12	13	6	11	10	4	15	6	6	4	4	5	5	9	7	....	6	14	8	12	....	1	1	9	6	3	....	1	9	206	28	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
California	167	T.	2	4	4	3	1	6	8	6	4	5	4	....	....	....	1	....	....	....	3	1	2	5	3	2	5	5	1	1	1	6	3	86	25	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Colorado	70	T.	15	18	11	4	10	19	14	2	2	11	5	14	....	1	4	7	2	3	9	12	16	15	11	16	4	4	12	13	10	14	5	283	30	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Connecticut	21	T.	10	8	1	....	10	1	....	....	....	....	3	6	3	....	4	11	....	14	....	....	1	....	....	....	....	1	1	7	13	....	4	98	17	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	1	2	....	....	....	14	9	A.
Delaware	5	T.	....	....	....	....	2	....	2	....	....	....	....	2	1	....	....	2	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Dist. of Columbia	4	T.	1	....	....	....	1	1	1	1	....	1	1	1	....	....	....	1	....	....	1	....	1	1	....	....	....	1	....	1	....	....	....	14	14	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Florida	61	T.	13	12	9	8	10	12	13	15	11	14	14	13	14	17	7	6	8	13	10	8	13	16	19	16	15	10	10	16	11	12	8	373	31	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Georgia	67	T.	2	6	2	8	8	4	3	10	3	20	3	11	....	1	2	7	3	2	....	8	16	11	7	5	8	2	2	11	6	10	10	201	29	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Idaho	34	T.	6	10	7	5	6	4	12	12	3	1	5	7	....	2	3	....	....	....	....	3	3	5	1	1	....	3	3	4	....	....	....	106	22	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Illinois	84	T.	5	1	23	19	16	20	19	25	8	5	46	5	4	41	17	3	....	2	8	9	5	2	1	....	....	8	28	5	14	1	17	337	28	T.
		A.	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	1	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	3	3	A.
Indiana	58	T.	5	....	3	14	16	17	12	9	10	5	15	6	1	1	1	2	6	4	8	3	12	2	2	2	....	....	4	8	1	....	8	177	27	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Indian Territory	20	T.	2	1	1	1	1	1	2	1	2	1	1	....	....	....	....	1	1	....	....	1	2	3	1	....	....	....	1	....	....	....	1	25	19	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Iowa	128	T.	....	4	40	10	13	5	4	11	....	21	21	....	14	34	....	....	7	25	21	18	1	....	....	....	8	11	6	1	13	21	8	317	23	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Kansas	88	T.	18	19	16	23	26	31	25	19	13	20	12	3	8	12	4	1	2	....	10	17	19	9	....	....	7	3	6	....	1	8	13	345	27	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Kentucky	41	T.	1	....	1	12	3	2	1	12	3	3	10	3	....	....	3	5	6	....	5	3	4	2	1	3	1	....	4	4	....	....	2	94	24	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Louisiana	46	T.	4	7	9	9	8	11	5	5	10	12	7	11	9	9	4	4	5	3	7	5	9	13	6	2	1	8	10	9	5	6	4	207	31	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Maine	25	T.	9	11	....	....	6	1	....	....	....	2	7	2	4	....	....	....	....	....	1	1	....	....	....	....	....	4	8	3	5	....	3	69	15	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Maryland	42	T.	13	....	....	1	17	14	20	9	8	12	14	18	1	....	....	7	1	12	10	2	5	8	3	1	5	12	....	15	....	....	2	210	24	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Massachusetts	48	T.	15	15	1	....	34	....	3	....	....	....	3	5	1	....	....	12	....	14	....	....	....	1	....	1	1	13	2	3	19	1	2	146	19	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Michigan	106	T.	2	....	3	14	....	1	2	9	24	4	11	21	....	16	12	1	11	17	....	1	9	24	3	1	....	5	23	3	....	6	5	228	25	T.
		A.	....	....	....	1	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2	2	A.
Minnesota	67	T.	....	....	15	3	3	1	1	6	3	5	1	....	15	14	1	6	15	26	....	2	2	1	....	1	8	4	....	3	20	12	....	168	24	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Mississippi	57	T.	5	8	10	10	9	9	12	5	9	7	4	10	8	6	13	7	1	9	10	3	7	10	6	1	1	7	9	6	4	7	5	218	31	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Missouri	86	T.	9	9	24	20	34	19	25	28	15	27	26	2	2	14	8	1	6	6	12	22	11	4	....	....	3	15	21	4	....	4	17	388	28	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Montana	54	T.	11	1	....	2	1	....	4	14	10	3	7	13	4	3	1	1	1	....	1	2	3	5	3	....	....	....	7	19	3	....	....	119	23	T.
		A.	....	....	....	....	....	2	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	3	2	A.
Nebraska	137	T.	3	26	23	20	34	18	14	5	18	23	30	6	26	13	....	12	6	2	23	27	25	2	....	8	19	17	20	11	13	10	....	454	28	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Nevada	40	T.	1	....	1	4	6	5	6	2	....	....	3	3	....	....	....	....	....	....	....	1	1	8	10	9	4	4	8	4	....	....	7	94	20	T.
		A.	....	....	1	....	1	1	1	1	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	7	7	A.
New Hampshire	21	T.	11	9	....	....	6	....	....	....	1	1	1	5	....	....	....	....	....	5	....	....	....	....	....	....	1	8	4	4	2	....	....	58	13	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
New Jersey	48	T.	21	2	....	....	18	18	26	5	1	2	18	18	....	....	1	16	8	30	15	2	4	3	....	....	1	2	1	26	12	....	7	257	24	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
New Mexico	31	T.	5	4	2	2	....	1	....	....	....	....	1	3	....	....	....	4	5	5	5	4	7	1	3	2	2	3	6	2	1	6	5	79	23	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
New York	129	T.	42	4	1	13	16	3	5	5	13	8	9	35	1	....	18	14	18	31	14	3	2	9	11	3	2	16	17	42	6	1	2	364	30	T.
		A.	....	....	....	....	....	1	1	....	....	....	....	1	....	....	....	....	....	1	....	1	....	....	....	....	....	....	....	....	....	....	....	....	4	4	A.
North Carolina	56	T.	5	4	....	5	14	17	20	17	13	11	15	15	3	1	3	17	2	....	3	15	17	9	7	9	12	2	5	9	5	3	5	263	29	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
North Dakota	48	T.	1	9	5	1	1	....	2	1	3	5	3	1	15	3	2	1	18	5	....	1	....	....	....	3	3	1	1	3	13	2	1	104	26	T.
		A.	....	....	....	....	....	....	2	....	....	....	....	....	....	1	....	....	1	....	....	....	....	....	....	....	....	....	....	1	....	....	....	7	5	A.
Ohio	101	T.	34	5	1	40	38	38	28	19	21	8	18	21	2	....	6	....	15	22	26	5	24	25	4	....	2	2	22	41	7	2	6	482	28	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Oklahoma	36	T.	3	2	5	1	....	8	11	5	1	....	....	....	....	....	....	....	....	....	....	3	4	3	....	....	3	1	....	....	....	2	2	54	15	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2	4	2	....	....	....	1	1	....	....	....	....	....	153	21	A.
Oregon	70	T.	7	11	20	6	3	13	12	17	12	11	16	3	1	7	3	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Pennsylvania	91	T.	27	2	....	8	21	23	26	5	9	13	17	18	2	....	5	2	3	24	26	5	10	12	2	2	2	16	21	11	....	....	....	312	26	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Rhode Island	6	T.	4	....	....	....	1	2	....	....	....	....	....	....	....	....	....	1	....	3	....	....	....	3	....	....	....	2	....	....	....	....	....	....	16	7	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
South Carolina	54	T.	5	4	....	4	8	11	15	16	10	8	8	19	3	3	1	16	12	1	1	14	24	15	17	8	11	5	5	17	15	8	9	293	30	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
South Dakota	56	T.	2	6	2	2	4	1	2	1	2	7	5	7	21	4	1	....	5	6	....	3	6	1	....	5	8	....	1	4	11	....	....	117	25	T.
		A.	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	2	2	A.
Tennessee	56	T.	8	6	4	20	13	7	11	15	12	2	10	11	....	4	5	16	4	5	7	18	21	11	2	4	2	....	9	2	1	2	15	247	29	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Texas	126	T.	4	7	7	6	2	2	2	....	....	....	....	2	....	....	2	....	2	10	12	5	4	6	2	4	....	5	6	4	1	2	2	99	23	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Utah	64	T.	9	9	....	2	9	16	12	....	....	....	1	6	....	....	3	....	....	....	3	10	15	14	17	5	....	5	15	23	15	6	3	198	21	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Vermont	12	T.	9	6	....	....	2	1	....	....	....	....	3	8	1	....	....	....	....	4	....	....	....	1	1	2	1	7	3	9	....	....	....	58	15	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Virginia	40	T.	2	4	....	7	15	7	13	12	8	6	16	11	1	....	3	13	1	4	7	16	1	8	5	1	6	10	7	11	1	....	8	204	28	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Washington	71	T.	2	9	10	8	1	8	5	2	2	1	13	2	....	1	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	65	14	T.
		A.	....	....	....	....	....	....	....	....	....	1	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1	1	A.
West Virginia	47	T.	15	4	....	9	12	9	20	8	10	6	12	6	....	1	1	1	1	10	11	13	5	9	5	1	3	....	5	3	1	....	2	183	27	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Wisconsin	63	T.	....	....	19	7	4	3	....	6	4	8	17	1	2	11	....	1	23	22	6	1	1	7	....	....	....	10	3	....	7	30	1	194	23	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Wyoming	38	T.	10	10	8	9	8	3	4	7	5	3	3	13	5	1	....	1	....	....	....	6	8	6	6	3	3	5	5	7	3	1	1	144	27	T.
		A.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	0	0	A.
Sums	2963	T.	388	303	309	364	490	417	442	361	310	314	452	386	182	233	153	219	216	352	293	313	371	339	177	129	171	271	347	387	259	210	220	9,378	....	T.
		A.	0	1	0	2	1	7	6	1	1	1	0	0	1	1	0	1	2	0	0	1	1	1	0	0	0	0	1	0	0	0	0	29	....	A.

TABLE V.—*Accumulated amounts of precipitation for each 5 minutes, for storms in which the rate of fall equaled or exceeded 0.25 in any 5 minutes, or 0.75 in 1 hour during July, 1904, at all stations furnished with self-registering gages.*

Stations.	Date.	Total duration. From—	Total duration. To—	Total amount of precipitation.	Excessive rate. Began—	Excessive rate. Ended—	Amount before excessive began.	Depths of precipitation (in inches) during periods of time indicated. 5 min.	10 min.	15 min.	20 min.	25 min.	30 min.	35 min.	40 min.	45 min.	50 min.	60 min.	80 min.	100 min.	120 min.
	1	2	3	4	5	6	7														
Albany, N. Y.	12	5:40 p. m.	7:15 p. m.	0.60	6:02 p. m.	6:22 p. m.	0.02	0.12	0.27	0.43	0.52	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Alpena, Mich.	11			0.46														0.19	.....	.....	.....
Amarillo, Tex.	3	9:05 p. m.	11:45 p. m.	1.12	9:25 p. m.	10:20 p. m.	0.04	0.05	0.11	0.35	0.52	0.68	0.74	0.78	0.82	0.87	0.96	1.02	.....	.....	.....
Asheville, N. C.	31	12:40 p. m.	D. N.	1.12	12:56 p. m.	1:15 p. m.	0.08	0.27	0.37	0.48	0.54	0.56	.....	.....	.....	.....	.....	.....	.....	.....	.....
Atlanta, Ga.	9	2:19 p. m.	4:08 p. m.	1.01	2:50 p. m.	3:10 p. m.	0.09	0.24	0.56	0.79	0.87	0.90	.....	.....	.....	.....	.....	.....	.....	.....	.....
Atlantic City, N. J.	18			0.59							0.44	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Augusta, Ga.	16	3:30 p. m.	6:05 p. m.	0.64	3:33 p. m.	3:52 p. m.	T.	0.14	0.30	0.56	0.60	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Do	31	2:45 p. m.	4:25 p. m.	1.22	2:49 p. m.	†	T.	0.11	0.31	0.54	0.73	†	.....	.....	.....	.....	.....	.....	.....	.....	.....
Baltimore, Md.	5			0.52									0.52	.....	.....	.....	.....	.....	.....	.....	.....
Binghamton, N. Y.	17–18	9:35 p. m.	D. N.	1.28	9:58 p. m.	10:36 p. m.	0.01	0.12	0.16	0.17	0.19	0.24	0.43	0.76	0.84	.....	.....	.....	.....	.....	.....
Birmingham, Ala.	12	D. N.	7:20 a. m.	1.68	2:39 a. m.	3:30 p. m.	0.01	0.13	0.23	0.24	0.25	0.37	0.77	1.03	1.14	1.21	1.26	.....	.....	.....	.....
Bismarck, N. Dak.	17			0.42					0.22												
Block Island, R. I.	22–23			1.23														0.28			
Boise, Idaho.	5			0.23								0.23									
Boston, Mass.	5			0.39														0.36			
Buffalo, N. Y.	9	11:55 a. m.	4:00 p. m.	0.83	12:06 p. m.	12:40 p. m.	0.01	0.10	0.22	0.29	0.38	0.56	0.65	0.76	.....	.....	.....	.....	.....	.....	.....
Cairo, Ill.	11	8:40 p. m.	10:30 p. m.	0.94	9:23 p. m.	9:53 p. m.	0.04	0.06	0.21	0.40	0.72	0.82	0.88	.....	.....	.....	.....	.....	.....	.....	.....
Do	20	6:54 p. m.	11:00 p. m.	1.20	7:07 p. m.	7:37 p. m.	0.03	0.05	0.22	0.46	0.67	0.82	0.92	.....	.....	.....	.....	.....	.....	.....	.....
Cape Henry, Va.	7	3:30 p. m.	4:45 p. m.	0.98	3:46 p. m.	4:26 p. m.	T.	0.08	0.15	0.22	0.44	0.58	0.75	0.86	0.96	.....	.....	.....	.....	.....	.....
Do	12	4:30 p. m.	8:25 p. m.	1.67	4:50 p. m.	5:35 p. m.	0.01	0.16	0.52	0.61	0.62	0.68	0.74	0.82	0.90	1.00	.....	.....	.....	.....	.....
Charleston, S. C.	2	2:13 p. m.	4:27 p. m.	2.21	2:57 p. m.	3:49 p. m.	0.01	0.21	0.60	0.90	1.01	1.10	1.39	1.48	1.61	1.99	2.13	2.20	.....	.....	.....
Charlotte, N. C.	21	2:37 p. m.	9:45 p. m.	2.00	3:10 p. m.	4:07 p. m.	0.08	0.08	0.24	0.42	0.57	0.76	0.81	0.84	0.93	1.08	1.38	1.45	.....	.....	.....
Do	28	10:00 a. m.	11:20 a. m.	0.72	10:03 a. m.	10:18 a. m.	T.	0.19	0.53	0.70	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Chattanooga, Tenn.	5			0.30				0.23													
Chicago, Ill.	11			0.62														0.50			
Cincinnati, Ohio.	5			0.33														0.32			
Cleveland, Ohio.	22			0.54					0.49												
Columbia, Mo.	10			0.59						0.51											
Columbia, S. C.	7	6:53 p. m.	9:20 p. m.	0.89	8:28 p. m.	9:08 p. m.	0.08	0.22	0.30	0.34	0.36	0.57	0.71	0.72	0.81	.....	.....	.....	.....	.....	.....
Columbus, Ohio.	8	2:57 p. m.	3:34 p. m.	0.88	3:02 p. m.	3:21 p. m.	0.01	0.16	0.49	0.70	0.87	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Concord, N. H.	1	12:25 p. m.	2:00 p. m.	0.74	12:43 p. m.	1:04 p. m.	0.01	0.15	0.34	0.55	0.68	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Do	26	1:55 p. m.	3:02 p. m.	0.86	2:11 p. m.	2:51 p. m.	0.01	0.24	0.31	0.52	0.60	0.65	0.66	0.69	0.82	.....	.....	.....	.....	.....	.....
Corpus Christi, Tex.	24			0.79														0.40			
Davenport, Iowa.	30–31			0.93							0.50										
Denver, Colo.	24	6:35 p. m.	9:50 p. m.	0.69	7:15 p. m.	7:35 p. m.	.....	0.06	0.21	0.31	0.45	0.48	0.53	0.55	.....	.....	.....	.....	.....	.....	.....
Des Moines, Iowa.	18–19	10:50 p. m.	7:55 a. m.	4.32	10:55 p. m.	11:35 p. m.	T.	0.32	0.53	0.68	0.74	0.98	1.24	1.34	1.42	.....	.....	.....	.....	.....	.....
					1:45 a. m.	2:35 a. m.	1.77	0.14	0.23	0.29	0.35	0.40	0.53	0.76	1.24	1.86	1.99	2.08	.....	.....	.....
Detroit, Mich.	22			0.76					0.59												
Dodge, Kans.	25			0.30														0.27			
Dubuque, Iowa.	3			0.34											0.25						
Duluth, Minn.	3			1.05											0.70						
Eastport, Me.	13			0.92														0.47			
Elkins, W. Va.	19	3:05 p. m.	3:30 p. m.	0.63	3:09 p. m.	3:25 p. m.	T.	0.29	0.60	0.63	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Erie, Pa.	28	12:20 p. m.	2:40 p. m.	0.76	12:49 p. m.	1:10 p. m.	0.04	0.24	0.38	0.47	0.53	0.56	0.60	.....	.....	.....	.....	.....	.....	.....	.....
Escanaba, Mich.	30	3:15 a. m.	7:45 a. m.	1.27	5:30 a. m.	6:20 a. m.	0.41	0.08	0.19	0.24	0.29	0.46	0.55	0.58	0.66	0.76	0.80	0.85	.....	.....	.....
Evansville, Ind.	8	3:30 p. m.	4:40 p. m.	0.77	3:31 p. m.	3:50 p. m.	T.	0.22	0.61	0.72	0.77	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Do	11	9:58 a. m.	12:40 p. m.	1.52	10:08 a. m.	10:58 a. m.	0.02	0.08	0.33	0.75	0.83	0.86	0.95	1.05	1.19	1.28	1.33	.....	.....	.....	.....
Do	20	4:25 a. m.	6:50 a. m.	1.84	4:32 a. m.	5:22 a. m.	T.	0.06	0.15	0.23	0.34	0.40	0.64	0.89	1.24	1.43	1.60	.....	.....	.....	.....
Fort Smith, Ark.	9			0.88														0.48			
Fort Worth, Tex.	12	7:15 p. m.	9:00 p. m.	1.04	7:30 p. m.	8:00 p. m.	0.01	0.21	0.30	0.46	0.70	0.83	0.90	0.92	.....	.....	.....	.....	.....	.....	.....
Galveston, Tex.	24	D. N.	11:55 a. m.	2.32	6:20 a. m.	8:20 a. m.	0.25	0.05	0.13	0.22	0.41	0.47	0.59	0.66	0.66	0.72	0.74	1.02	1.15	1.35	1.56
Grand Junction, Colo.	29			0.17						0.16											
Grand Rapids, Mich.	30–31			1.28														0.40			
Green Bay, Wis.	30	5:20 a. m.	7:30 a. m.	1.10	6:30 a. m.	7:15 a. m.	0.24	0.07	0.14	0.25	0.39	0.45	0.53	0.63	0.74	0.82	0.85	.....	.....	.....	.....
Hannibal, Mo.	6	10:05 a. m.	11:28 a. m.	0.93	10:29 a. m.	11:18 a. m.	0.01	0.09	0.11	0.13	0.13	0.14	0.40	0.63	0.78	0.87	0.91	.....	.....	.....	.....
Harrisburg, Pa.	28			0.77							0.40										
Hatteras, N. C.	19	1:15 a. m.	2:10 a. m.	0.75	1:20 a. m.	1:40 a. m.	0.01	0.08	0.36	0.56	0.66	0.69	.....	.....	.....	.....	.....	.....	.....	.....	.....
Huron, S. Dak.	28–29			0.51						0.33											
Indianapolis, Ind.	5	6:05 a. m.	7:05 a. m.	0.98	6:05 a. m.	6:41 a. m.	0.00	0.31	0.57	0.65	0.76	0.78	0.84	0.94	0.97	.....	.....	.....	.....	.....	.....
Do	6	8:03 p. m.	10:45 p. m.	1.30	8:53 p. m.	9:38 p. m.	0.02	0.05	0.27	0.31	0.31	0.31	0.54	0.88	1.14	1.22	1.25	..	.....	.....	.....
Jacksonville, Fla.	10	6:40 p. m.	7:35 p. m.	1.00	6:43 p. m.	7:02 p. m.	T.	0.28	0.66	0.96	1.00	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Do	23	10:00 a. m.	11:55 a. m.	0.72	10:41 a. m.	11:12 a. m.	T.	0.06	0.22	0.47	0.55	0.60	0.67	0.71	.....	.....	.....	.....	.....	.....	.....
Jupiter, Fla.	22	1:18 p. m.	3:45 p. m.	1.08	1:28 p. m.	2:00 p. m.	0.06	0.19	0.56	0.89	0.92	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Kalispell, Mont.	1–2			0.43														0.11			
Kansas City, Mo.	5–6	11:00 p. m.	6:10 a. m.	1.88	11:06 p. m.	12:15 a. m.	0.01	0.09	0.19	0.25	0.51	0.64	0.77	0.91	0.95	0.97	0.99	1.13	1.33	.....	.....
Key West, Fla.	28			0.63														0.49			
Knoxville, Tenn.	27–28			1.43								0.48									
La Crosse, Wis.	17			0.49								0.46									
Lewiston, Idaho.	1			0.52														0.26			
Lexington, Ky.	28	11:30 a. m.	1:45 p. m.	1.15	11:35 a. m.	11:55 a. m.	0.01	0.25	0.60	0.97	0.06	1.09	.....	.....	.....	.....	.....	.....	.....	.....	.....
Lincoln, Nebr.	5–6			1.21														*			
Little Rock, Ark.	6			1.14														0.84			
Los Angeles, Cal.	5			T.																	
Louisville, Ky.	11			0.49						0.41											
Lynchburg, Va.	9	11:40 a. m.	11:20 p. m.	0.84	11:48 a. m.	12:13 p. m.	0.01	0.20	0.40	0.50	0.65	0.82	.....	.....	.....	.....	.....	.....	.....	.....	.....
Macon, Ga.	23	2:25 p. m.	4:20 p. m.	0.80	2:35 p. m.	3:00 p. m.	0.01	0.10	0.30	0.47	0.64	0.72	.....	.....	.....	.....	.....	.....	.....	.....	.....
Memphis, Tenn.	4	11:15 p. m.	D. N.	0.98	11:33 p. m.	11:57 p. m.	0.06	0.09	0.22	0.50	0.71	0.83	0.85	0.88	.....	.....	.....	.....	.....	.....	.....
Do	16	9:30 p. m.	10:25 p. m.	0.63	9:44 p. m.	10:06 p. m.	0.04	0.12	0.30	0.40	0.52	0.58	.....	.....	.....	.....	.....	.....	.....	.....	.....
Meridian, Miss.	7	12:58 p. m.	5:00 p. m.	0.71	1:08 p. m.	1:30 p. m.	0.02	0.16	0.32	0.42	0.48	0.51	0.54	.....	.....	.....	.....	.....	.....	.....	.....
Milwaukee, Wis.	3–4			1.08														0.42			
Minneapolis, Minn.	30	1:46 a. m.	D. N.	1.31	1:46 a. m.	2:31 a. m.	0.00	0.20	0.42	0.47	0.53	0.72	1.00	1.16	1.21	1.30	.....	.....	.....	.....	.....
Montgomery, Ala.	12	5:20 a. m.	6:15 a. m.	0.71	5:20 a. m.	5:36 a. m.	0.00	0.19	0.49	0.63	0.67	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Do	23	12:20 p. m.	3:30 p. m.	1.24	1:30 p. m.	1:55 p. m.	0.47	0.09	0.44	0.58	0.64	0.71	.....	.....	.....	.....	.....	.....	.....	.....	.....
Nantucket, Mass.	1			0.37					0.34												
Nashville, Tenn.	11–12	10:35 p. m.	2:20 a. m.	1.27	11:08 p. m.	11:44 p. m.	T.	0.07	0.13	0.33	0.46	0.52	0.69	0.80	.....	.....	.....	.....	.....	.....	.....
Do	19	5:12 p. m.	6:15 p. m.	1.54	5:26 p. m.	5:55 p. m.	0.01	0.20	0.61	0.96	1.26	1.39	1.47	1.50	.....	.....	.....	.....	.....	.....	.....
New Haven, Conn.	24–25			0.67														0.24			
New Orleans, La.	5	12:25 p. m.	1:30 p. m.	0.69	12:26 p. m.	12:41 p. m.	T.	0.13	0.37	0.63	0.65	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Do	6	12:01 p. m.	1:15 p. m.	1.14	12:02 p. m.	12:22 p. m.	T.	0.28	0.69	0.99	1.08	1.12	.....	.....	.....	.....	.....	.....	.....	.....	.....
Do	11	12:55 p. m.	2:20 p. m.	2.01	1:14 p. m.	1:54 p. m.	T.	0.18	0.53	0.83	0.91	1.26	1.53	1.72	1.83	1.87	.....	.....	.....	.....	.....
Do	17	12:22 p. m.	1:10 p. m.	0.89	12:23 p. m.	1:03 p. m.	T.	0.15	0.18	0.20	0.27	0.48	0.66	0.80	0.88	.....	.....	.....	.....	.....	.....
New York, N. Y.	8			1.03														0.59			
Norfolk, Va.	6	6:03 p. m.	8:10 p. m.	1.25	6:05 p. m.	6:25 p. m.	0.01	0.15	0.36	0.84	0.91	0.95	0.99	1.03	1.08	.....	.....	.....	.....	.....	.....
Northfield, Vt.	26			0.63														0.47			
North Head, Wash.	14			0.54														0.10			
Oklahoma, Okla.	7			0.41														0.28			
Omaha, Nebr.	20			0.62														0.45			
Palestine, Tex.	3			1.07														0.44			
Parkersburg, W. Va.	19			0.40									0.40								
Pensacola, Fla.	11	6:10 a. m.	9:02 a. m.	1.09	7:10 a. m.	7:58 a. m.	0.02	0.10	0.21	0.32	0.40	0.46	0.59	0.70	0.81	0.91	0.98	.....	.....	.....	.....
Do	21	12:02 p. m.	2:44 p. m.	2.61	12:04 p. m.	1:24 p. m.	0.01	0.08	0.23	0.46	0.55	0.61	0.63	0.73	0.88	1.02	1.18	1.32	2.11	.....	.....

TABLE V.—*Accumulated amounts of precipitation for each 5 minutes, etc.*—Continued.

Stations.	Date.	Total duration. From—	Total duration. To—	Total amount of precipitation.	Excessive rate. Began—	Excessive rate. Ended—	Amount before excessive began.	Depths of precipitation (in inches) during periods of time indicated. 5 min.	10 min.	15 min.	20 min.	25 min.	30 min.	35 min.	40 min.	45 min.	50 min.	60 min.	80 min.	100 min.	120 min.
	1	2	3	4	5	6	7														
Pensacola, Fla	28	7:36 a. m.	8:58 a. m.	0.76	7:38 a. m.	7:53 a. m.	0.01	0.20	0.50	0.71	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Philadelphia, Pa	7	1:00 p. m.	1:57 p. m.	1.11	1:20 p. m.	1:45 p. m.	0.05	0.10	0.40	0.65	0.89	1.04	1.06	.....	.....	.....	.....	.....	.....	.....	.....
Pittsburg, Pa	22	.....	.....	0.49	.....	.....	.....	.....	.....	0.48	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Pocatello, Idaho	26	.....	.....	0.23	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.23	.....	.....	.....
Portland, Me	5	.....	.....	0.51	.....	.....	.....	.....	.....	.....	0.50	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Portland, Oreg	14-15	.....	.....	0.35	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.10	.....	.....	.....
Pueblo, Colo	23-24	4:48 p. m.	1:00 a. m.	1.42	5:09 p. m.	5:54 p. m.	0.03	0.16	0.29	0.38	0.48	0.59	0.71	0.81	0.85	0.92	.....	.....	.....	.....	.....
Raleigh, N. C	8	5:10 p. m.	6:30 p. m.	0.92	5:22 p. m.	5:45 p. m.	T.	0.21	0.46	0.65	0.81	0.85	.....	.....	.....	.....	.....	.....	.....	.....	.....
Richmond, Va	23-24	3:34 p. m.	8:15 a. m.	0.79	3:42 p. m.	4:09 p. m.	T.	0.17	0.42	0.60	0.75	1.02	1.08	1.11	.....	.....	.....	.....	.....	.....	.....
Rochester, N. Y	9	.....	.....	0.97	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.64	.....	.....	.....
Sacramento, Cal	21	.....	.....	T.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
St. Louis, Mo	11.	4:07 p. m.	5:55 p. m.	0.53	4:09 p. m.	4:21 p. m.	T.	0.15	0.28	0.50	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
St. Paul, Minn	30	1:58 a. m.	3:40 a. m.	2.10	1:58 a. m.	2:55 a. m.	0.00	0.32	0.46	0.62	0.74	0.98	1.21	1.40	1.47	1.58	1.80	2.00	.....	.....	.....
Salt Lake City, Utah	28	.....	.....	0.33	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.24	.....	.....	.....
San Antonio, Tex	2	2:20 p. m.	3:20 p. m.	1.14	2:22 p. m.	3:11 p. m.	T.	0.19	0.40	0.64	0.68	0.69	0.70	0.75	0.85	1.02	1.12	.....	.....	.....	.....
Do	24	10:10 a. m.	11:05 a. m.	0.82	10:20 a. m.	10:45 a. m.	0.05	0.21	0.38	0.52	0.64	0.72	0.75	.....	.....	.....	.....	.....	.....	.....	.....
San Diego, Cal. †	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Sandusky, Ohio	4-5	.....	.....	1.91	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.70	.....	.....	.....
San Francisco, Cal	15	.....	.....	0.02	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Savannah, Ga	10	6:19 p. m.	8:05 p. m.	1.36	6:41 p. m.	7:36 p. m.	0.05	0.08	0.13	0.18	0.22	0.24	0.43	0.62	0.81	0.99	1.15	1.28	.....	.....	.....
Do	24	3:25 p. m.	7:30 p. m.	2.52	3:47 p. m.	5:05 p. m.	0.09	0.16	0.20	0.37	0.59	0.74	0.77	0.83	1.08	1.31	1.54	1.97	2.31	.....	.....
Do	28-29	3:30 p. m.	D. N.	5.53	3:53 p. m.	4:08 p. m.	0.10	0.31	0.56	0.79	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
					5:18 p. m.	6:06 p. m.	1.00	0.21	0.38	0.54	0.66	0.74	0.79	0.96	1.20	1.25	1.32	.....	.....	.....	.....
					6:27 p. m.	6:53 p. m.	2.36	0.17	0.42	0.47	0.87	1.13	1.22	1.28	.....	.....	.....	.....	.....	.....	.....
					9:41 p. m.	10:14 p. m.	3.94	0.15	0.32	0.54	0.83	1.13	1.40	1.51	.....	.....	.....	.....	.....	.....	.....
Scranton, Pa	12	2:44 p. m.	6:21 p. m.	1.10	3:11 p. m.	3:27 p. m.	0.02	0.37	0.49	0.69	0.78	0.82	0.86	.....	.....	.....	.....	.....	.....	.....	.....
Do	17-18	10:30 p. m.	D. N.	2.21	11:08 p. m.	12:04 a. m.	0.01	0.14	0.49	0.79	0.87	0.99	1.12	1.41	1.46	1.68	1.89	2.00	.....	.....	.....
Seattle, Wash	14-15	.....	.....	0.39	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.22	.....	.....	.....
Shreveport, La	27	.....	.....	0.81	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.57	.....	.....	.....
Spokane, Wash	1	.....	.....	0.17	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.05	.....	.....	.....
Springfield, Ill	27	4:06 p. m.	7:59 p. m.	2.16	4:34 p. m.	4:50 p. m.	0.08	0.37	0.61	0.68	0.70	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
					5:34 a. m.	6:20 p. m.	0.81	0.13	0.18	0.22	0.27	0.42	0.53	0.63	0.81	0.89	0.92	.....	.....	.....	.....
Springfield, Mo	26	12:59 p. m.	2:28 p. m.	0.81	1:13 p. m.	1:58 p. m.	T.	0.15	0.22	0.33	0.43	0.56	0.63	0.67	0.74	0.81	.....	.....	.....	.....	.....
Syracuse, N. Y	17-18	.....	.....	0.48	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.41	.....	.....	.....
Tampa, Fla	7	6:35 p. m.	7:50 p. m.	0.77	6:49 p. m.	7:20 p. m.	0.02	0.15	0.38	0.50	0.57	0.62	0.67	0.70	.....	.....	.....	.....	.....	.....	.....
Do	14	5:40 p. m.	7:00 p. m.	1.06	5:46 p. m.	6:32 p. m.	0.01	0.23	0.35	0.65	0.77	0.83	0.84	0.87	0.91	0.99	.....	.....	.....	.....	.....
Do	16	4:30 p. m.	6:00 p. m.	0.67	5:21 p. m.	5:45 p. m.	0.02	0.10	0.20	0.42	0.57	0.64	.....	.....	.....	.....	.....	.....	.....	.....	.....
Taylor, Tex	22-23	9:20 p. m.	3:30 p. m.	3.44	9:25 p. m.	10:10 p. m.	T.	0.22	0.43	0.64	0.75	1.01	1.28	1.36	1.44	1.49	.....	.....	.....	.....	.....
					6:45 a. m.	7:05 a. m.	1.96	0.17	0.41	0.67	0.82	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Toledo, Ohio	9	5:10 p. m.	6:30 p. m.	1.07	5:19 p. m.	6:08 p. m.	T.	0.27	0.59	0.63	0.80	0.84	0.84	0.84	0.94	1.04	1.07	.....	.....	.....	.....
Topeka, Kans	5-6	8:22 p. m.	5:55 a. m.	2.53	8:30 p. m.	9:41 p. m.	T.	0.05	0.26	0.33	0.35	0.35	0.36	0.38	0.48	0.63	0.82	1.15	1.34	.....	.....
Do	21	2:45 p. m.	3:30 p. m.	1.17	2:45 p. m.	3:10 p. m.	0.00	0.35	0.69	1.03	1.13	1.16	.....	.....	.....	.....	.....	.....	.....	.....	.....
Valentine, Nebr	21	2:10 a. m.	7:40 a. m.	2.20	2:15 a. m.	3:05 a. m.	T.	0.11	0.26	0.51	0.86	1.05	1.13	1.25	1.33	1.46	1.56	.....	.....	.....	.....
Vicksburg, Miss	13	5:40 p. m.	6:52 p. m.	0.96	5:54 p. m.	6:14 p. m.	0.01	0.33	0.64	0.84	0.95	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Washington, D. C	7	2:25 p. m.	3:40 p. m.	0.81	2:27 p. m.	2:47 p. m.	T.	0.05	0.23	0.54	0.79	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Do	8-9	6:15 p. m.	12:40 a. m.	0.71	6:20 p. m.	6:50 p. m.	0.03	0.13	0.29	0.36	0.41	0.46	0.51	.....	.....	.....	.....	.....	.....	.....	.....
Wichita, Kans	6	1:07 a. m.	5:55 a. m.	3.21	1:08 a. m.	2:30 a. m.	0.01	0.15	0.37	0.55	0.70	1.04	1.45	1.74	1.98	2.11	2.27	2.50	2.81	.....	.....
Do	14	7:30 p. m.	9:58 p. m.	1.51	8:25 p. m.	9:00 p. m.	0.01	0.08	0.19	0.54	0.84	1.09	1.31	1.47	1.49	.....	.....	.....	.....	.....	.....
Wilmington, N. C	9	4:40 p. m.	8:45 p. m.	1.92	4:43 p. m.	5:42 p. m.	T.	0.08	0.26	0.51	0.73	0.94	1.07	1.19	1.31	1.38	1.50	1.71	.....	.....	.....
Wytheville, Va	4-5	.....	.....	0.36	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.24	.....	.....	.....
Yankton, S. Dak	25	.....	.....	0.40	.....	.....	.....	.....	0.38	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Havana, Cuba	28	2:27 p. m.	6:40 p. m.	2.36	2:27 p. m.	3:20 p. m.	0.00	0.48	0.85	1.43	1.74	1.84	1.89	1.89	1.89	2.02	2.14	.....	.....	.....	.....
San Juan, Porto Rico	20	.....	.....	0.89	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	0.52	.....	.....	.....

*Self-register not working †Instrument failed to register after 3:09 p. m. ‡No precipitation during month.

TABLE VII.—*Heights of rivers referred to zeros of gages, July, 1904.*

Stations.	Distance to mouth of river.	Danger line on gage.	Highest water. Height.	Highest water. Date.	Lowest water. Height.	Lowest water. Date.	Mean stage.	Monthly range.
Mississippi River.	*Miles.*	*Feet.*	*Feet.*		*Feet.*		*Feet.*	*Feet.*
St. Paul, Minn	1,954	14	5.2	1,2	3.3	29	4.3	1.9
Red Wing, Minn	1,914	14	3.7	8	0.8	31	2.3	2.9
Reeds Landing, Minn	1,884	12	5.2	8,9	2.4	29,30	3.9	2.8
La Crosse, Wis	†,819	12	6.5	10,11	3.5	31	5.3	3.0
Prairie du Chien, Wis	1,759	18	6.6	1	3.5	31	5.6	3.1
Dubuque, Iowa	1,699	18	7.2	6-8	3.9	31	6.2	3.3
Clinton, Iowa	1,629	16	6.9	1	3.8	31	5.9	3.1
Leclaire, Iowa	1,609	10	4.8	1,7	2.6	31	4.1	2.2
Davenport, Iowa	1,593	15	6.2	1	3.5	30	5.2	2.7
Muscatine, Iowa	1,562	16	7.2	1	4.4	31	6.1	2.8
Galland, Iowa	1,472	8	3.8	1	2.0	30	2.9	1.8
Keokuk, Iowa	1,463	15	6.4	1	3.3	30	5.1	3.1
Hannibal, Mo	1,402	13	8.9	9	4.5	31	6.7	4.4
Grafton, Ill	1,306	23	14.5	12,13	7.5	31	10.4	7.0
St. Louis, Mo	1,264	30	28.4	12,13	13.3	31	21.3	15.1
Chester, Ill	1,189	30	23.8	13	12.5	31	18.5	11.3
New Madrid, Mo	1,003	34	24.2	15,16	14.8	31	20.3	9.4
Memphis, Tenn	843	33	21.9	17,18	13.2	31	18.0	8.7
Helena, Ark	767	42	29.9	19	20.5	31	25.6	9.4
Arkansas City, Ark	635	42	37.0	22	29.7	31	34.2	7.3
Greenville, Miss	595	42	31.0	22,23	25.0	31	28.6	6.0
Vicksburg, Miss	474	45	36.5	1	30.2	14,15	32.6	6.3
Natchez, Miss	373	46	38.2	1	31.9	16	34.2	6.3
Baton Rouge, La	240	35	28.3	1	23.5	17	25.3	4.8
Donaldsonville, La	188	28	22.1	1	18.1	18,19	19.6	4.0
New Orleans, La	108	16	14.2	1	11.9	18	12.8	2.3
Yellowstone River.								
Glendive, Mont	98	17	8.2	4-6	5.2	29,31	6.5	3.0
James River.								
Lamoure, N. Dak	.....	14	2.2	15	1.2	30,31	1.8	1.0
Huron, S. Dak	210	25	3.1	1	0.8	28-31	1.8	2.3
Missouri River.								
Townsend, Mont	2,504	10	5.6	1,2,6	4.2	27-31	4.9	1.4
Fort Benton, Mont	2,285	12	3.2	1,2	1.1	26,27,31	2.1	2.1
Bismarck, N. Dak	1,309	14	7.3	8,9	4.6	29-31	5.8	2.7
Missouri River—Cont'd.								
Pierre, S. Dak	1,114	19	9.2	1	5.6	31	7.4	3.6
Sioux City, Iowa	784	18	11.6	1	9.0	31	10.5	2.6
Omaha, Nebr	669	10	12.5	1	8.9	31	10.5	3.6
Plattsmouth, Nebr	641	17	8.0	1	5.2	31	6.7	2.8
St. Joseph, Mo	481	10	8.7	1,4,7	5.4	31	7.4	3.3
Kansas City, Mo	388	21	25.2	8	13.0	31	18.5	12.2
Glasgow, Mo	231	.....	18.2	10	8.9	31	12.6	9.3
Boonville, Mo	199	20	22.1	10	12.0	31	15.9	10.1
Hermann, Mo	103	24	22.7	12	12.4	31	17.1	10.3
Illinois River.								
Peoria, Ill	135	14	8.8	17	7.6	31	8.1	1.2
Allegheny River.								
Warren, Pa	177	14	5.2	10	0.3	31	1.7	4.9
Oil City, Pa	123	13	4.8	11	0.9	1,2,4,29-31	1.9	3.9
Parker, Pa	73	20	6.9	11	1.0	27-29	2.5	5.9
Freeport, Pa	29	20	13.2	11	2.7	27,28	5.3	10.5
Red Bank Creek.								
Brookville, Pa	35	8	4.4	10	0.5	20-28,31	1.2	3.9
Clarion River.								
Clarion, Pa	32	10	7.9	10	1.1	27,28	2.7	6.8
Conemaugh River.								
Johnstown, Pa	64	7	5.4	10	1.4	31	2.2	4.0
Cheat River.								
Rowlesburg, W. Va	36	14	3.3	13	1.6	28	2.?	1.7
Youghiogheny River.								
Confluence, Pa	59	23	1.6	11	0.0	21,22	0.6	1.6
West Newton, Pa	15	10	2.7	11	0.4	20,21	1.1	2.3
Monongahela River.								
Weston, W. Va	161	18	0.4	2	— 0.6	24	—0.2	1.0
Fairmont, W. Va	119	25	16.4	2	14.0	23-31	14.6	2.4
Greensboro, Pa	81	18	8.5	2,3	6.4	21	7.3	2.1
Lock No. 4, Pa	40	28	8.5	3	5.9	20,22	6.9	2.6
Ohio River.								
Pittsburg, Pa	966	22	9.8	11	2.9	18	6.0	6.9
Davis Island Dam, Pa	960	25	10.7	8,11	3.3	30	5.7	7.4

TABLE VII.—*Heights of rivers referred to zeros of gages*—Continued.

Stations.	Distance to mouth of river.	Danger line on gage.	Highest water.		Lowest water.		Mean stage.	Monthly range.
			Height.	Date.	Height.	Date.		
Ohio River—Cont'd.	*Miles.*	*Feet.*	*Feet.*		*Feet.*		*Feet.*	*Feet.*
Beaver Dam, Pa	925	27	14.4	11	3.9	30	7.4	10.5
Wheeling, W. Va	875	36	14.2	9	3.6	31	7.3	10.6
Parkersburg, W. Va	785	36	15.5	10	4.8	29, 31	8.4	10.7
Point Pleasant, W. Va	703	39	15.4	10	3.2	27, 31	7.6	12.2
Huntington, W. Va	660	50	19.3	11	6.1	31	11.3	13.2
Catlettsburg, Ky	651	50	19.5	11	4.1	28	10.4	15.4
Portsmouth, Ohio	612	50	21.0	11	5.6	28, 29	11.6	15.4
Cincinnati, Ohio	499	50	22.3	13	7.1	31	13.4	15.2
Madison, Ind	413	46	17.9	14	6.4	31	11.6	11.5
Louisville, Ky	367	28	8.3	13, 14	3.7	30, 31	6.0	4.6
Evansville, Ind	184	35	16.0	17	5.6	31	10.1	10.4
Paducah, Ky	47	40	15.6	17	5.5	31	11.4	10.1
Cairo, Ill	1	45	29.7	15	17.6	31	24.8	12.1
Beaver River.								
Ellwood Junction, Pa	10	14	4.8	8	2.7	31	3.3	2.1
Muskingum River.								
Zanesville, Ohio	70	20	17.3	8	8.0	28	9.7	9.3
Little Kanawha River.								
Creston, W. Va	50	20	4.7	3	1.6	31	2.9	3.1
New River.								
Radford, Va	155	14	5.6	1	0.7	21	1.5	4.9
Hinton, W. Va	95	14	3.8	1	1.3	22-25	1.9	2.5
Great Kanawha, River.								
Charleston, W. Va	58	30	7.6	9	4.6	5	6.8	3.0
Scioto River.								
Columbus, Ohio	110	17	12.0	9	2.3	22	3.9	9.7
Licking River.								
Falmouth, Ky	30	25	4.0	10	0.8	3-5, 31	2.0	3.2
Miami River.								
Dayton, Ohio	77	18	4.5	8	1.0	27, 28, 31	1.9	3.5
Kentucky River.								
Beattyville, Ky	254	30	2.0	12	0.3	28-31	0.8	1.7
High Bridge, Ky	117	17	10.0	3, 14	9.2	24-27	9.5	0.8
Frankfort, Ky	65	31	6.6	4, 5	5.8	25-28	6.2	0.8
Wabash River.								
Mount Carmel, Ill	50	15	6.6	12	1.9	31	4.0	4.7
Clinch River.								
Speers Ferry, Va	156	20	1.6	1	— 0.6	27, 31	0.2	2.2
Clinton, Tenn	52	25	8.5	3	3.6	31	5.4	4.9
Holston River.								
Bluff City, Tenn	170	15	1.8	1	0.3	16, 21-23	0.6	1.5
Rogersville, Tenn	103	14	3.1	1	1.5	18-25	1.9	1.6
French Broad River.						{7, 8, 17, 20-22, 30, 31}		
Asheville, N. C	144	6	0.0	9, 26, 28	— 0.7		—0.5	0.7
Leadvale, Tenn	70	15	0.6	1	— 1.3	21	—0.6	1.9
Hiwassee River.								
Charleston, Tenn	18	22	1.8	1, 10, 13	0.6	21	1.2	1.2
Tennessee River.								
Knoxville, Tenn	635	29	3.1	1	0.5	19-22	1.2	2.6
Kingston, Tenn	556	25	2.9	3	1.3	28, 29	1.0	1.6
Chattanooga, Tenn	452	33	4.3	3	1.7	22	2.8	2.6
Bridgeport, Ala	402	24	2.7	4	0.7	23	1.6	2.0
Florence, Ala	255	16	2.3	8, 9	0.5	27, 29-31	1.2	1.8
Riverton, Ala	225	25	2.6	9	— 0.3	26	1.0	2.9
Johnsonville, Tenn	95	21	4.0	10	1.4	28-30	2.6	2.6
Cumberland River.								
Burnside, Ky	518	50	3.2	1	0.2	15, 16	0.9	3.0
Celina, Tenn	383	45	4.1	2	1.4	27, 31	2.2	2.7
Carthage, Tenn	308	40	3.1	1	1.4	26, 27, 30	2.1	1.7
Nashville, Tenn	193	40	6.2	1	2.7	31	4.0	3.5
Clarksville, Tenn	126	42	8.3	2	3.2	31	5.6	5.1
Arkansas River.								
Wichita, Kans	832	10	10.2	9	0.9	31	3.9	9.3
Webbers Falls, Ind. T	465	23	25.1	13	7.8	31	16.6	17.3
Fort Smith, Ark	403	22	25.5	12	7.9	31	16.9	17.6
Dardanelle, Ark	256	21	23.5	14	8.6	30	17.0	14.9
Little Rock, Ark	176	23	25.0	15	10.4	31	19.1	14.6
White River.								
Newport, Ark	150	26	9.9	14	3.2	31	6.9	6.7
Yazoo River.								
Yazoo City, Miss	80	25	10.7	1	5.3	15	7.5	5.4
Ouachita River.								
Camden, Ark	304	39	11.5	26	7.0	22	8.7	4.5
Monroe, [illegible]	122	40	22.8	1	8.0	27	14.1	14.8
Red River.								
Arthur City, Tex	688	27	17.0	1	5.2	30, 31	8.0	11.8
Fulton, Ark	515	28	22.1	3	9.5	22, 31	12.7	12.6
Shreveport, La	327	29	24.1	1	6.8	31	12.8	17.3
Alexandria, La	118	33	29.6	1	6.6	31	16.4	23.0
Atchafalaya River.								
Melville, La	100	31	31.7	1	29.0	31	30.0	2.7
Mohawk River.								
Tribeshill, N. Y	42	.....	— 2.7	{1, 16, 17, 19-22}	— 2.3	2	—2.5	0.4
Schenectady, N. Y	19	.....	2.0	31	0.9	{1-4, 9-13 21-26}	1.1	1.1
Hudson River.								
Glens Falls, N. Y	197	.....	6.3	2-4	2.8	23, 27	4.6	3.5
Troy, N. Y	154	.....	5.3	29	2.0	20-22, 24	3.6	3.3
Albany, N. Y	147	.....	5.0	16	1.0	7, 21	3.2	4.0
Passaic River.								
Chatham, N. J	69	.....	3.1	9	2.1	1-6	2.4	1.0
Pompton River.								
Pompton Plains, N. J	6	.....	4.8	1	3.7	22-29, 31	4.0	1.1
North Branch Susquehanna.								
Binghamton, N. Y	306	16	3.2	30	1.9	24	2.2	1.3
Towanda, Pa	262	16	2.0	31	0.7	1	1.1	1.3
Wilkesbarre, Pa	183	17	4.5	13	3.3	25	3.7	1.2
West Branch Susquehanna.								
Lockhaven, Pa	65	12	4.0	11	— 0.2	19-31	—0.3	4.2
Williamsport, Pa	39	20	8.1	11	1.0	30, 31	2.5	7.1
Susquehanna River.								
Harrisburg, Pa	69	17	5.7	12	2.2	5, 23, 28-31	2.9	3.5

Stations.	Distance to mouth of river.	Danger line on gage.	Highest water.		Lowest water.		Mean stage.	Monthly range.
			Height.	Date.	Height.	Date.		
Juniata River.	*Miles.*	*Feet.*	*Feet.*		*Feet.*		*Feet.*	*Feet.*
Huntingdon, Pa	90	24	7.7	10	3.4	5, 31	4.2	4.3
Potomac River.								
Cumberland, Md	290	8	3.6	24	2.9	11, 12, 16	3.2	0.7
Harpers Ferry, W. Va	172	18	3.6	13	0.1	22-24	1.1	3.5
Shenandoah River.								
Riverton, Va	58	22	0.7	1	0.5	2-31	0.5	0.2
James River.								
Lynchburg, Va	260	18	1.8	1	0.7	20-22	1.0	1.1
Richmond, Va	111	12	0.8	1	— 0.3	24	0.1	1.1
Dan River.								
Danville, Va	55	8	1.2	29	— 0.2	8, 19-22	0.1	1.4
Roanoke River.								
Clarksville, Va	196	12	8.2	26	2.3	21	4.5	5.9
Weldon, N. C	129	30	14.5	25	8.3	21, 22	9.8	6.2
Cape Fear River.								
Fayetteville, N. C	112	38	14.0	26	2.0	21	6.5	12.0
Waccamaw River.								
Conway, S. C	40	7	2.6	16, 31	1.4	11, 25	2.0	1.2
Pedee River.								
Cheraw, S. C	149	27	18.1	1	2.0	7-9, 20, 21	4.5	16.1
Smiths Mills, S. C	51	16	10.0	7	2.8	1, 23	6.2	7.2
Lynch Creek.								
Effingham, S. C	35	12	5.6	30	3.6	25, 26	4.3	2.0
Black River.								
Kingstree, S. C	45	24	1.9	12, 13	0.0	14-23	0.8	1.9
Wateree River.								
Camden, S. C	37	15	15.7	1	5.4	21	7.8	10.3
Congaree River.								
Columbia, S. C	52	12	1.9	24, 25	0.0	20, 21	0.4	1.9
Santee River.								
St. Stephens, S. C	50	12	6.0	5	— 0.3	1, 2, 23	2.1	6.3
Savannah River.								
Calhoun Falls, S. C	347	15	2.2	3, 26, 30	1.6	16	1.9	0.6
Augusta, Ga	268	32	10.7	24	3.6	23	6.0	7.1
Broad River.								
Carlton, Ga	30	11	4.2	9	1.4	21	1.9	2.8
Oconee River.								
Dublin, Ga	79	30	0.6	3	— 1.0	19-22	—0.5	1.6
Ocmulgee River.								
Macon, Ga	203	18	4.6	31	0.7	10	1.5	3.9
Abbeville, Ga	96	11	2.0	3-5, 27, 28	0.6	19, 20	1.2	1.4
Flint River.								
Woodbury, Ga	.....	.....	1.0	25	— 0.1	18	0.2	1.1
Albany, Ga	80	20	1.5	2.3	0.2	20-22	0.8	1.3
Chattahoochee River.								
Oakdale, Ga	305	18	2.0	1, 2, , 18	0.5	{3, 5, 6, 10-12, 25, 28}	1.1	1.5
West Point, Ga	239	20	2.5	1	1.3	8	1.9	1.2
Chosa River.								
Rome, Ga	271	30	2.8	17	0.6	12	1.5	2.2
Gadsden, Ala	144	22	2.0	1	— 0.6	31	0.3	2.6
Lock No. 4, Ala	116	17	2.0	1, 2	0.2	25-28, 30, 31	7.3	1.8
Wetumpka, Ala	6	45	5.4	1	1.5	17, 18, 27	2.7	3.9
Tallapoosa River.								
Milstead, Ala	.....	.....	3.2	1	1.1	18, 19	1.8	2.1
Alabama River.								
Montgomery, Ala	265	35	2.5	14	0.5	19, 20, 28	1.3	2.0
Selma, Ala	212	35	3.9	2	— 0.3	20	1.1	4.2
Tombigbee River.								
Columbus, Miss	303	33	— 0.8	28, 29	— 2.9	20, 21	—1.9	2.1
Demopolis, Ala	155	35	4.5	4	— 1.3	22	1.9	5.8
Black Warrior River.								
Tuscaloosa, Ala	90	43	9.8	2	4.7	22	6.4	5.1
Sabine River.								
Logansport, La	180	45	8.4	8	1.8	22	5.3	5.6
Orange, Tex	10	7	1.0	1-17	0.4	26-31	0.8	0.6
Neches River.								
Rockland, Tex	110	20	2.0	12	0.3	29-31	1.1	1.7
Beaumont, Tex	40	10	1.4	8, 9	0.5	1	1.0	0.9
Trinity River.								
Dallas, Tex	330	25	8.5	1	2.0	16, 18	3.3	6.5
Riverside, Tex	100	40	5.8	8, 9	0.7	23	2.6	5.1
Liberty, Tex	42	25	8.1	11, 12	4.0	24	5.9	4.1
Brazos River.								
Kopperl, Tex	369	21	6.2	1	0.2	25, 26	1.8	6.0
Waco, Tex	301	24	9.8	1	2.6	29, 30	4.3	7.2
Hempstead, Tex	215	40	17.0	3	— 0.1	22, 23	3.6	17.1
Booth, Tex	76	39	6.5	10	3.2	2-4	4.4	3.3
Colorado River.								
Ballinger, Tex	400	21	3.0	1, 4, 25	1.4	14-19	1.9	1.6
Austin, Tex	214	18	6.7	1	1.1	20-23	2.2	5.6
Columbus, Tex	100	24	16.7	3	6.5	30, 31	8.6	10.2
Red River of the North.								
Moorhead, Minn	418	26	13.7	1	8.8	30, 31	10.4	4.9
Kootenai River.								
Bonners Ferry, Idaho	.....	.....	19.7	5	10.6	31	15.8	9.1
Pend d'Oreille River.								
Newport, Wash	.....	.....	12.1	1	5.3	31	8.6	6.8
Snake River.								
Lewiston, Idaho	144	24	10.3	1, 2	3.8	31	7.0	6.5
Riparia, Wash	67	.....	9.8	2	4.6	31	7.2	5.2
Columbia River								
Wenatchee, Wash	473	40	34.0	10	23.0	31	30.1	11.0
Umatilla, Oreg	270	25	17.2	3	11.0	31	15.1	6.2
The Dalles, Oreg	166	40	28.3	1, 4	16.6	31	24.5	11.7
Willamette River.								
Albany, Oreg	118	20	2.5	1	1.6	31	2.0	0.9
Salem, Oreg	84	20	1.7	1, 2, 17	0.8	27-31	1.2	0.9
Portland, Oreg	12	15	16.1	1	8.9	31	13.7	7.2
Sacramento River.								
Red Bluff, Cal	265	23	3.3	1	0.5	30, 31	1.2	2.8
Sacramento, Cal	64	25	15.6	1	10.5	31	12.6	5.1

HAWAIIAN CLIMATOLOGICAL DATA.

By R. C. LYDECKER, Territorial Meteorologist.

Meteorological Observations at Honolulu, July, 1904.

The station is at 21° 18′ north, 157° 50′ west. It is the Hawaiian Weather Bureau station Punahou. (See fig. 2, No. 1, in the MONTHLY WEATHER REVIEW for July, 1902, page 365.)

Hawaiian standard time is 10h 30m slow of Greenwich time. Honolulu local mean time is 10h 31m slow of Greenwich.

The pressure is corrected for temperature and reduced to sea level, and the gravity correction, —0.06, has been applied.

The average direction and force of the wind and the average cloudiness for the whole day are given unless they have varied more than usual, in which case the extremes are given. The scale of wind force is 0 to 12, or Beaufort scale. Two directions of wind, or values of wind force, or amounts of cloudiness, connected by a dash, indicate change from one to the other.

Rainfall for twenty-four hours is measured at 9 a. m. local, or 7:31 p. m., Greenwich time.

The rain gage, 8 inches in diameter, is 1 foot above ground. Thermometer, 9 feet above ground. Ground is 43 feet and the barometer 50 feet above sea level.

Date.	Pressure at sea level.	Temperature.		During twenty-four hours preceding 1 p. m. Greenwich time, or 2:30 a. m. Honolulu time.								Total rainfall at 9 a. m., local time.
				Temperature.		Means.		Wind.		Average cloudiness.	Sea-level pressures.		
		Dry bulb.	Wet bulb.	Maximum.	Minimum.	Dew-point.	Relative humidity.	Prevailing direction.	Force.		Maximum.	Minimum.	
	*	†	†			‡	‡		§				
1	29.98	72	66.5	82	71	62.3	67	ne.	1-0	3	30.00	29.96	0.02
2	30.01	73	66	83	71	63.3	66	ne.	1-0	2	30.02	29.96	0.05
3	29.99	73	66.5	82	70	61.3	62	ne.	0-2	3	30.03	29.96	0.09
4	29.99	73	68	82	70	63.3	64	ne.	1-3	3-6	30.03	29.96	0.06
5	29.99	74	68	83	72	66.3	74	ne.	1-3	4	30.03	29.96	0.24
6	30.00	75	67.5	82	72	66.3	72	ne.	2	4	30.08	29.96	0.05
7	29.99	74	69.5	82	72	65.7	70	ne.	2-1	4	30.02	29.96	0.03
8	29.98	73	68	83	72	65.7	71	ne.	1	6-4	30.04	29.96	0.05
9	29.96	73	68	83	72	63.7	71	ne.-nne.	2-0	4	30.01	29.94	0.04
10	29.95	73	66.5	83	70	64.0	68	ne.	0-2	2	29.98	29.91	0.02
11	29.98	74	66.5	82	73	61.3	61	ne.	3-2	2	29.98	29.91	0.01
12	29.96	75	68	84	74	63.3	64	ne.	3-2	2	30.00	29.94	0.04
13	29.98	74	66	83	75	64.3	64	ne.	4-2	3	30.00	29.95	0.00
14	30.01	75	68.5	84	74	62.7	61	ne.	3-4	2	30.03	29.96	0.00
15	30.05	75	67	84	75	64.0	65	ne.	1-3	3	30.07	30.01	0.01
16	30.01	74	67	83	74	63.0	63	ne.	3-5	3-3	30.07	29.99	T.
17	29.95	70	68.5	83	72	63.7	68	ne.	3-0	3-7-1	30.02	29.93	0.22
18	29.92	73	68	82	69	65.7	77	ene.-ne.	0-1	8-4	29.97	29.90	0.01
19	29.95	76	68.5	83	73	66.0	72	ne.	1-2	2-6	29.99	29.91	0.12
20	30.00	75	68	84	73	65.0	65	ne.	2-0	7-4	30.01	29.94	T.
21	29.97	76	70.5	84	74	64.3	64	ne.	2-0	3-7	30.02	29.96	0.01
22	29.97	77	69	83	73	67.7	72	ne.	0-1	3	30.01	29.94	T.
23	29.98	76	68	84	76	64.3	64	ne.	0-3	4	30.02	29.96	0.00
24	29.97	76	67	84	75	63.3	62	ne.	1-3	3	30.01	29.96	0.00
25	29.98	75	67	83	75	62.0	60	ne.	2 4	3	30.02	29.96	0.01
26	29.96	74	66	83	72	62.7	63	ne.	1-3	3	29.99	29.92	0.05
27	29.96	75	67	83	71	62.3	61	ne.	2-4	3	29.98	29.94	0.00
28	29.97	73	69	84	75	64.0	64	ne.	1-3	1-5	29.99	29.92	T.
29	30.00	76	69	85	71	67.3	73	ne.	0-1	3-5	30.02	29.94	T.
30	29.98	73	70	85	71	66.3	70	ne.	2-0	2-7	30.03	29.97	0.44
31	29.94	74	69	82	71	68.5	79	ne.	1-0	4-8	30.00	29.93	0.52
Sums													2.09
Means	29.978	74.2	67.8	83.2	72.6	64.3	67.0		1.7	3-6	30.013	29.948	
Departure.	—.015					—0.7	—1.5						+0.30

Mean temperature for the month of July, 1904 (9 + 2 + 9), + 3 = 77.1°; normal is 77.3°.
Mean pressure for the month of July, 1904, (9 + 3) + 2 = 29.980; normal is 29.995.

* This pressure is as recorded at 1 p. m., Greenwich time. † These temperatures are observed at 6 a. m., local, or 4:31 p. m., Greenwich time. ‡ These values are the means of (6 + 9 + 2 + 9) ÷ 4. § Beaufort scale.

Maximum thermometer set at 9 p. m. and minimum at 2 p. m., local time.

GENERAL SUMMARY FOR JULY, 1904.

Honolulu.—Temperature mean for the month, 77.1°; normal, 7.73°; average daily maximum, 83.2°; average daily minimum, 72.6°; mean daily range, 10.6°; greatest daily range, 14° (28th and 39th); least daily range, 8° (several); highest temperature, 85° (28th and 29th); lowest temperature, 69° (17th).

Barometer average, 29.980; normal, 29.995; highest, 30.07 (24th and 15th); lowest, 29.90 (17th); greatest 24-hour change, that is from any given hour of one day to the same hour of the next, .07; lows passed this point, 10th, 17th, 18th, 26th, and 31st; highs, 14th and 15th.

Relative humidity average, 67.0 per cent; normal, 68.5 per cent; mean dew-point, 64.3°; normal, 65.0°; mean absolute moisture, 6.64 grains per cubic foot; normal, 6.81 grains.

Rainfall, 2.09 inch; normal, 1.79 inches; greatest rainfall in twenty-four hours, 0.52 inch (from 9 a. m. 30th to 9 a. m. 31st); rain record days, 21; normal, 19.

Trade wind days, 31; normal, 29; average force of wind, Beaufort scale and during daylight only, 1.7; average cloudiness, tenths of sky, 3.6; normal, 4.0.

Rainfall data for July, 1904.

Stations.	Elevation.	Amount.
HAWAII.		
HILO, e. and ne.	*Feet.*	*Inches.*
Waiakea	50	11.42
Hilo (town)	.....	.....
Puueo	.....	.....
Kaumana	1,250	19.16
Pepeekeo	100	10.11
Puuohua	.....	.....
Hakalau	200	13.82
Honohina	300	17.49
Puuohua	.....	.....
Laupahoehoe	500	27.61
Ookala	400	16.75
HAMAKUA, ne.		
Kukaiau	250	15.52
Paauilo	300	14.58
Paauhau	300	8.33
Paapau	1,150	11.05
Honokaa (Mill)	425	10.00
Honokaa (Meinicke)	1,100	10.49
Kukuihaele	700	10.21
KOHALA, n.		
Awini Ranch	1,100	14.52
Niulii	200	5.95
Halawa	450	.....
Kohala (Mission)	521	5.93
Kohala (Sugar Co.)	270	6.18
Hawi Mill	700	6.05
Puakea Ranch	600	3.98
Puuhue Ranch	1,847	4.70
Waimea	2,720	3.82
KONA, w.		
Huehue	2,000	2.70
Holualoa	1,350	9.93
Kaukahoku Leheula	.....	.....
Kainaliu	.....	.....
Kealakekua	1,580	8.68
Napoopoo	25	1.80
Hoopuloa	.....	.....
Hoopuloa	.....	.....
Puuwaawaa Ranch	.....	.....
Huehue	.....	.....
KAU, se.		
Kahuku Ranch	1,680	4.42
Honuapo	15	1.09
Naalehu	650	2.53
Hilea	310	0.40
Pahala	850	0.66
Volcano House	4,000	6.68
PUNA, e.		
Olaa, Mountain View (Russel)	.....	.....
Olaa Plantation (Mill)	.....	.....
Olaa (20 miles)	.....	.....
Kapoho	110	.....
Pahoa	600	17.06
MAUI.		
Lahaina	.....	.....
Waiopae Ranch	.....	.....
Kaupo (Mokulau), s	285	4.16
Kipahulu, s	308	5.07
Hana	.....	.....
Nahiku, ne	850	11.41
Nahiku	1,600	.....
Haiku, n	700	4.32
Kula (Erehwon), n	4,500	0.99
Kula (Waiakoa), n	2,700	.....
Puuomalei, n	1,400	3.40
Wailuku, ne	.....	.....
Paia	180	1.46

Stations.	Elevation.	Amount.
MAUI—*Cont'd.*	*Feet.*	*Inches.*
Haleakala Ranch	.....	0.55
LANAI.		
Keomuku	2,000	.....
OAHU.		
Punahou (W. B.), sw	47	2.09
Kulaokahua (Castle), sw	50	1.54
Makiki Reservoir	.....	.....
U. S. Naval Station, sw	6	1.24
Kapiolani Park, sw	.....	.....
College Hills	175	3.36
Manoa (Woodlawn Dairy), e	285	9.22
Manoa (Rhodes Gardens)	360	11.06
Insane Asylum	30	2.60
School street (Bishop), sw	.....	.....
Kamehameha School	.....	.....
Kalihi-Uka, sw	485	8.42
Nuuanu (W. W. Hall), sw	50	2.65
Nuuanu (Wyllie street)	250	4.41
Nuuanu (Elec. Station), sw	405	5.20
Nuuanu (Luakaha), e	850	12.06
U. S. Experiment Station	350	3.51
Kaliula	.....	.....
Laniakea (Nahuina)	.....	.....
Tantalus Heights (Frear)	1,360	10.26
Waimanalo, ne	300	1.51
Maunawili, ne	300	3.47
Kaneohe	100	3.50
Ahuimanu, ne	350	5.69
Kahuku, n	.....	.....
Waialua	.....	.....
Wahiawa	900	1.70
Ewa Plantation, s	60	0.55
U. S. Magnetic Station	.....	.....
Waipahu	200	0.00
Moanalua	15	1.56
Pacific Heights	.....	.....
KAUAI.		
Lihue (Grove Farm), e	200	2.09
Lihue (Molokoa), e	300	3.19
Lihue (Kukaua), e	1,000	6.23
Lihue (Kilohana)	400	3.59
Kealia, e	15	1.33
Kilauea (Plantation), ne	325	3.84
Hanalei, n	10	10.01
Waioli	.....	.....
Haena	.....	.....
Waiawa	.....	.....
Eleele	150	0.92
Wahiawa (Mountain)	.....	.....
McBryde (Residence)	850	3.63
Lawai (Gov. Road)	450	5.50
Lawai, w	215	1.52
Lawai, e	800	4.09
Koloa	100	0.81
Lawai Beach	.....	1.94
Delayed reports.		
Waiawa	.....	0.29
Hawi Mill	.....	1.57
Hakalau	.....	8.14
Honohina	.....	9.16
Olaa Mill	.....	8.20
Kahuku	.....	0.45
Haleakala Ranch	.....	0.09
Hilo	.....	8.25
Lawai, w	.....	1.11
Kula (Erehwon)	.....	1.09
U. S. Magnetic Station	.....	0.41

NOTE.—The letters n, s, e, w, and c show the exposure of the station relative to the winds.

Approximate percentages of district rainfall as compared with normal: Hawaii, South Hilo, 134 per cent; North Hilo, 231; Hamakua, variable, from 186 at Paauhau to 384 at Kukaiau; Kohala, 150; Waimea, 153; Kona, 112; Kau, variable, from 23 at Hilea to 141 at Naalehu. Island of Maui, variable, from 59 at Haleakala Ranch to 130 at Paia Oahu: Honolulu district, 135; Nuuanu, 112; Koolau, 128; Ewa, 134. Kauai: Lihue, 128; Hanalei, variable, from 97 at Kilauca to 193 at Hanalei. As will be seen from the above, the rainfall throughout the group was, with but few exceptions, in excess of the normal, especially so in the North Hilo and Hamakua districts of Hawaii.

The heaviest monthly rainfall reported was at Laupahoehoe, Hawaii, 27.61 inches. The heaviest 24-hour rainfalls were at Ookala and Paauilo, Hawaii, 5.90 and 5.17 inches, respectively, on the 12th.

Kohala, dew-point, 67.0; relative humidity, 79.0 per cent.

Ewa Mill, dew-point, 59.0°; relative humidity, 54.0 per cent; barometer average, 29.98 inches.

Temperature table for July, 1904.

Stations.	Elevation.	Mean max.	Mean min.	Cor. av'ge.	Highest.	Lowest.
	Feet.	°	°	°	°	°
Hilo	50					
Pepeekeo	100	78.2	69.2	73.0	81	67
Olaa Mill	210					
Kohala	321	78.7	67.8	72.5	80	65
Waimea	2,730	70.0	61.3	65.0	73	69
Volcano House	4,000	72.4	52.7	61.0	79	48
Waiakoa	2,700					
Keomuku	10					
Kinau Street (Castle)	50	83.9	72.8	77.1	86	68
United States Magnetic Station	50					
Ewa Mill	60	84.5	67.6	75.4	87	65
United States Experiment Station	350	84.9	70.9	77.5	88	69

Honolulu.—Lightning in ssw. on the evenings of the 6th and 7th; slight earthquake on 23d.

Reported from other stations: Pepeekeo, Hawaii: Hard earthquake shock at 1:55 p. m. on the 17th; snow still visible on mountain tops; bright morning glows at intervals; heavy surf 10th to 12th and 21st to 27th, inclusive; easterly winds throughout, force, 1.2; average cloudiness, 6.1. Kohala, trade winds all the month. Hilo, heavy earthquake on 17th.

COSTA RICAN CLIMATOLOGICAL DATA.

Communicated by Mr. H. PITTIER, Director, Physico-Geographic Institute.

TABLE 1.—*Hourly observations at the Observatory, San José de Costa Rica, during June, 1904.*

Hours.	Pressure.		Temperature.		Relative humidity.		Rainfall.		
	Observed, 1904.	Normal, 1889-1903.	Observed, 1904.	Normal, 1889-1903.	Observed, 1904.	Normal, 1889-1903.	Observed, 1904.	Normal, 1889-1903.	Duration, 1904.
	Inches.	*Inches.*	° *F.*	° *F.*	%	%	*Ins.*	*Ins.*	*Hrs.*
1 a. m	26.15	26.14	64.6	64.0	90	93	0.02	0.08	1.67
2 a. m	26.13	26.12	63.3	63.9	93	93	0.06	0.08	1.67
3 a. m	26.12	26.11	63.3	63.3	89	93	0.04	0.05	1.33
4 a. m	26.11	26.10	62.8	63.0	90	93	0.10	0.05	2.00
5 a. m	26.11	26.10	61.7	62.8	93	93	0.09	0.04	2.00
6 a. m	26.12	26.11	61.3	62.4	94	93	0.04	0.04	1.35
7 a. m	26.13	26.12	62.1	62.8	90	84	0.00	0.02	.....
8 a. m	26.14	26.13	66.0	66.9	79	84	0.00	0.02	.....
9 a. m	26.15	26.14	71.1	70.3	69	77	.....	0.03	.....
10 a. m	26.15	26.15	73.8	73.7	68	70	.....	0.06	.....
11 a. m	26.15	26.14	76.8	75.7	66	62	.....	0.06	.....
Noon	26.14	26.13	78.8	82.6	58	67	.....	0.15	.....
1 p. m	26.12	26.12	77.7	75.9	65	68	0.11	0.36	0.75
2 p. m	26.11	26.10	77.6	76.0	64	71	0.39	0.96	2.75
3 p. m	26.09	26.09	74.8	73.8	73	70	1.25	1.19	5.00
4 p. m	26.09	26.08	77.6	71.4	78	81	1.08	1.96	6.79
5 p. m	26.09	26.09	69.8	69.6	85	85	3.26	1.57	9.55
6 p. m	26.11	26.10	68.2	68.4	88	88	4.23	1.82	13.73
7 p. m	26.12	26.11	66.7	67.1	91	90	0.91	1.02	11.09
8 p. m	26.13	26.13	66.0	66.4	92	92	0.78	0.77	10.50
9 p. m	26.15	26.14	65.7	65.8	91	92	0.90	0.43	8.15
10 p. m	26.16	26.15	65.3	65.3	92	93	0.41	0.23	7.86
11 p. m	26.16	26.15	64.8	64.9	93	93	0.11	0.18	4.67
Midnight	26.16	26.15	64.4	64.6	93	93	0.10	0.09	3.42
Mean	26.13	26.12	68.5	68.2	82	85	.....	.....	.....
Minimum	26.05	26.01	58.3	55.8	36	.....	.....	.....	.....
Maximum	26.21	26.22	86.0	85.1	100	.....	.....	.....	.....
Total	.....	.....	.....	.....	.....	.....	13.98	11.26	94.28

REMARKS.—At San José the barometer is 3,835 feet above sea level. Readings are corrected for gravity, temperature, and instrumental error. The hourly readings for pressure, and wet and dry bulb thermometers, are obtained by means of Richard registering instruments, checked by direct observations every three hours from 7 a. m. to 10 p. m. The thermometers are 5 feet above ground and are corrected for instrumental errors. The total hourly rainfall is as given by Hottinger's self-register, checked once a day. Under maximum, the greatest hourly rainfall for the month is given. The standard rain gage is 5 feet above ground. Since January 1, 1902, observations at San José have been made on seventy-fifth meridian time, which is 0 hours, 36 minutes, 13.3 seconds *in advance* of San José local time. The normals for pressure, temperature, and relative humidity have been adjusted to this time; the normal for rainfall in Table 1 and the sunshine observations and normal in Table 2 refer to local time. At Port Limon the hours of direct observation are 8 a. m., 2 and 8 p. m., San José local time; the barometer is 14 feet above sea level. The means for temperature and relative humidity in Table 4 are obtained from two-hourly readings given by a Richard self-registering thermometer.

TABLE 2.—*San José, June, 1904.*

Time.	Sunshine.		Cloudiness.		Temperature of the soil at depth of—				
	Observed, 1904.	Normal, 1889-1903.	Observed, 1904.	Normal, 1889-1903.	6 inches.	12 inches.	24 inches.	48 inches.	120 inches.
	Hours.	*Hours.*	%	%	° *F.*	° *F.*	° *F.*	° *F.*	° *F.*
7 a. m	10.41	9.76	50	60	70.2	71.1	71.8	71.4	70.7
8 a. m	19.48	17.55	.....	.....	.....	.....	.....	.....	.....
9 a. m	22.56	20.05	.....	.....	.....	.....	.....	.....	.....
10 a. m	22.49	20.14	70	67	70.3	70.7	70.3	71.2	.....
11 a. m	19.52	18.36	.....	.....	.....	.....	.....	.....	.....
Noon	16.40	14.14	.....	.....	.....	.....	.....	.....	.....
1 p. m	12.48	11.14	78	84	71.2	71.1	71.6	72.5	.....
2 p. m	8.69	10.39	.....	.....	.....	.....	.....	.....	.....
3 p. m	8.10	6.89	.....	.....	.....	.....	.....	.....	.....
4 p. m	6.22	4.22	97	94	71.6	71.4	71.8	71.2	.....
5 p. m	2.50	1.70	.....	.....	.....	.....	.....	.....	.....
6 p. m	0.84	0.56	.....	.....	.....	.....	.....	.....	.....
7 p. m	.....	.....	88	92	71.4	71.4	70.5	71.2	.....
8 p. m	.....	.....	.....	.....	.....	.....	.....	.....	.....
9 p. m	.....	.....	.....	.....	.....	.....	.....	.....	.....
10 p. m	.....	.....	84	81	71.2	71.4	71.8	71.2	.....
11 p. m	.....	.....	.....	.....	.....	.....	.....	.....	.....
Midnight	.....	.....	.....	.....	.....	.....	.....	.....	.....
Mean	.....	.....	71	80	71.1	71.2	71.8	71.2	70.7
Total	149.68	135.04	.....	.....	.....	.....	.....	.....	.....

TABLE 3.—*Rainfall at stations in Costa Rica, June, 1904.*

Stations.	Height above sea level.	Observed, 1904.		Averages.		
		Amount.	Number of days.	Number of years.	Amount.	Number of days.
	Feet.	*Inches.*			*Inches.*	
Sipurio (Talamanca)	197	8.74	15	4	8.94	19
Boca Banano	10	5.63	19	8	5.98	15
Port Limon	10	.....	.....	10	5.67	12
Swamp Mouth	10	.71	15	6	5.08	10
Zent	66	7.36	17	3	3.70	16
Siquirres	197	1.02	10	6	9.33	16
Dos Novillos	400	.....	.....	.....	.....	.....
Guapiles	984	9.45	16	4	10.95	16
Cariblanco (Sarapiqui)	2,740	.....	.....	6	20.79	27
San Carlos	528	19.33	24	6	13.11	21
Las Lomas	873	13.23	17	4	7.60	12
Peralta	1,089	1.18	22	6	13.11	20
Turrialba	2,034	.....	.....	9	10.39	17
Juan Viñas	3,412	1.73	23	8	7.48	17
Santiago	3,609	10.75	20	3	8.31	19
Paraiso	4,383	9.92	20	3	19.45	18
Cachi	3,346	.....	.....	3	10.20	21
Las Concavas	4,386	10.51	28	3	10.47	24
Cartago	4,761	6.50	11	3	12.40	24
Tres Rios	4,265	11.61	22	15	11.14	18
San Francisco Guadalupe	3,894	13.78	23	8	13.39	22
San José	3,806	13.98	22	15	11.26	23
La Verbena	3,740	13.35	23	8	12.48	25
Nuestro Amo	2,595	7.52	18	8	10.20	17
Alajuela	3,117	.....	.....	4	11.97	18
San Isidro Alajuela	4,416	11.77	20	3	16.61	25
Las Cañas	2,559	.....	.....	.....	.....	.....
Puntarenas	.....	5.47	18	.....	.....	.....

Notes on earthquakes.—June 9, 9^h 10^m a. m., slight shock NNE.–SSW., intensity IV, duration 3 seconds. June 12, 1^h a. m., very light shock NW.—SE., intensity I, duration 2 seconds; 5^h 20^m p. m., very brief shock N.–S., intensity II, duration 2 seconds.

COSTA RICAN CLIMATOLOGICAL DATA.

Communicated by Mr. H. PITTIER, Director, Physico-Geographic Institute.

TABLE 1.—*Hourly observations at the Observatory, San José de Costa Rica, during July, 1904.*

Hours.	Pressure.		Temperature.		Relative humidity.		Rainfall.		
	Observed, 1904.	Normal, 1889–1903.	Observed, 1904.	Normal, 1889–1903.	Observed, 1904.	Normal, 1889–1903.	Observed, 1904.	Normal, 1889–1903.	Duration, 1904.
	Inches.	*Inches.*	° *F.*	° *F.*	%	%	*Ins.*	*Ins.*	*Hrs.*
1 a. m	26.15	26.14	63.1	64.0	94	91	0.02	0.04	1.00
2 a. m	26.13	26.12	62.8	63.7	92	91	.....	0.04	.....
3 a. m	26.12	26.11	62.4	63.1	89	91	0.32	0.08	1.00
4 a. m	26.11	26.10	62.3	62.8	88	91	0.12	0.04	1.50
5 a. m	26.12	26.10	62.1	62.8	87	91	0.02	0.01	0.25
6 a. m	26.12	26.11	62.1	62.4	86	91	.....	0.02	.....
7 a. m	26.13	26.12	62.4	63.0	85	90	.....	0.02	.....
8 a. m	26.14	26.13	65.8	65.3	76	84	.....	0.03	.....
9 a. m	26.15	26.14	70.5	69.3	70	76	.....	0.04	.....
10 a. m	26.15	26.15	71.4	72.1	68	73	.....	0.03	.....
11 a. m	26.15	26.15	74.3	74.1	65	69	.....	0.06	.....
Noon	26.14	26.13	76.2	75.0	60	68	.....	0.19	.....
1 p. m	26.13	26.13	75.2	75.6	69	69	0.45	0.58	1.05
2 p. m	26.11	26.11	75.4	75.0	68	70	0.64	0.72	1.16
3 p. m	26.09	26.09	75.2	73.6	68	69	0.48	0.94	3.68
4 p. m	26.09	26.09	72.7	71.9	75	77	1.01	1.47	2.20
5 p. m	26.09	26.09	69.9	70.0	81	82	0.40	1.40	2.79
6 p. m	26.10	26.10	68.0	68.4	86	84	0.80	1.51	4.33
7 p. m	26.12	26.11	66.4	66.9	88	88	0.28	0.87	4.28
8 p. m	26.13	26.11	65.5	66.0	90	89	0.40	0.72	3.17
9 p. m	26.14	26.14	64.8	65.5	90	89	0.12	0.35	2.50
10 p. m	26.15	26.15	64.5	64.9	90	90	0.04	0.23	0.50
11 p. m	26.16	26.16	63.8	64.6	91	90	.....	0.11	.....
Midnight	26.15	26.15	63.5	64.2	92	91	0.02	0.07	1.08
Mean	26.13	26.12	67.6	67.6	81	84	.....	.....	.....
Minimum	26.02	25.98	59.2	55.8	.....	.....	.....	.....	.....
Maximum	26.20	26.24	83.8	84.6	.....	.....	.....	.....	.....
Total	.....	.....	.....	.....	.....	.....	5.12	9.57	30.49

REMARKS.—At San José the barometer is 3,835 feet above sea level. Readings are corrected for gravity, temperature, and instrumental error. The hourly readings for pressure, and wet and dry bulb thermometers, are obtained by means of Richard registering instruments, checked by direct observations every three hours from 7 a. m. to 10 p. m. The thermometers are 5 feet above ground and are corrected for instrumental errors. The total hourly rainfall is as given by Hottinger's self-register, checked once a day. Under maximum, the greatest hourly rainfall for the month is given. The standard rain gage is 5 feet above ground. Since January 1, 1902, observations at San José have been made on seventy-fifth meridian time, which is 0 hours, 36 minutes, 13.3 seconds *in advance* of San José local time. The normals for pressure, temperature, and relative humidity have been adjusted to this time; the normal for rainfall in Table 1 and the sunshine observations and normal in Table 2 refer to local time. At Port Limon the hours of direct observation are 8 a. m., 2 and 8 p. m., San José local time; the barometer is 14 feet above sea level. The means for temperature and relative humidity in Table 4 are obtained from two-hourly readings given by a Richard self-registering thermometer.

TABLE 2.—*San José, July, 1904.*

Time.	Sunshine.		Cloudiness.		Temperature of the soil at depth of—				
	Observed, 1904.	Normal, 1889–1903.	Observed, 1904.	Normal, 1889–1903.	6 inches.	12 inches.	24 inches.	48 inches.	120 inches.
	Hours.	*Hours.*	%	%	° *F.*	° *F.*	° *F.*	° *F.*	° *F.*
7 a. m	5.21	8.32	70	66	69.4	70.0	71.1	69.4	70.5
8 a. m	13.77	15.86	.....	.....	.....	.....	.....	.....	.....
9 a. m	17.57	17.78	.....	.....	.....	.....	.....	.....	.....
10 a. m	17.05	16.41	80	72	68.2	69.8	70.9	70.7	.....
11 a. m	14.96	14.61	.....	.....	.....	.....	.....	.....	.....
Noon	8.88	10.49	.....	.....	.....	.....	.....	.....	.....
1 p. m	8.19	9.59	87	83	70.2	70.0	70.9	69.4	.....
2 p. m	7.60	9.19	.....	.....	.....	.....	.....	.....	.....
3 p. m	11.73	7.82	.....	.....	.....	.....	.....	.....	.....
4 p. m	7.06	5.42	90	92	70.7	70.3	70.9	70.7	.....
5 p. m	2.75	3.06	.....	.....	.....	.....	.....	.....	.....
6 p. m	0.98	1.21	.....	.....	.....	.....	.....	.....	.....
7 p. m	.....	.....	85	89	70.7	70.4	71.1	70.7	.....
8 p. m	.....	.....	.....	.....	.....	.....	.....	.....	.....
9 p. m	.....	.....	.....	.....	.....	.....	.....	.....	.....
10 p. m	.....	.....	82	78	70.3	70.3	71.1	70.7	.....
11 p. m	.....	.....	.....	.....	.....	.....	.....	.....	.....
Midnight	.....	.....	.....	.....	.....	.....	.....	.....	.....
Mean	.....	.....	83	80	70.2	70.7	71.1	70.7	70.5
Total	115.75	119.63	.....	.....	.....	.....	.....	.....	.....

TABLE 3.—*Rainfall at stations in Costa Rica, July, 1904.*

Stations.	Height above sea level.	Observed, 1904.		Averages.		
		Amount.	Number of days.	Number of years.	Amount.	Number of days.
	Feet.	*Inches.*			*Inches.*	
Sipurio (Talamanca)	197	6.57	18	4	11.26	20
Boca Banano	10	11.10	23	8	12.24	21
Port Limon	10	.....	.....	10	16.85	18
Swamp Mouth	10	1.42	23	6	12.01	17
Zent	66	14.41	14	3	9.80	21
Siquirres	197	.91	8	6	10.04	17
Dos Novillos	400	.....	.....	.....	.....	.....
Guapiles	984	1.54	20	4	12.32	24
Cariblanco (Sarapiquí)	2,740	.....	.....	6	19.37	27
San Carlos	528	14.06	26	6	16.50	26
Las Lomas	873	1.30	17	4	13.50	13
Peralta	1,089	1.38	19	6	12.01	23
Turrialba	2,034	.....	.....	9	10.83	20
Juan Viñas	3,412	2.48	16	8	8.03	18
Santiago	3,609	4.80	18	3	9.02	21
Paraiso	4,383	6.34	16	3	7.40	16
Cachi	3,346	.....	.....	3	9.37	21
Las Concavas	4,386	3.39	27	3	5.98	22
Cartago	4,761	.....	.....	3	4.92	10
Tres Rios	4,265	3.03	14	15	7.68	16
San Francisco Guadalupe	3,894	5.98	18	8	9.37	30
San José	3,806	5.12	18	15	9.61	22
La Verbena	3,740	4.37	19	8	8.86	20
Nuestro Amo	2,595	10.67	16	8	9.88	15
Alajuela	3,117	.....	.....	4	8.70	15
San Isidro Alajuela	4,416	9.76	22	3	12.95	21
Las Cañas	2,559	.....	.....	.....	.....	.....
Puntarenas	.....	4.25	20	.....	.....	.....

Notes on earthquakes.—None felt nor registered during the whole month.

CLIMATOLOGICAL DATA FOR JAMAICA.

Through the kindness of Mr. H. H. Cousins, chemist to the government of Jamaica and now in charge of the meteorological service of that island, we have received the following table in advance of the regular monthly weather report for Jamaica:

Comparative table of rainfall for July, 1904.

[Based upon the average stations only.]

Divisions.	Relative area.	Number of stations.	Rainfall.	
			1904.	Average.
	Per cent.		*Inches.*	*Inches.*
Northeastern division	25	19	5.71	6.39
Northern division	22	43	2.34	3.25
West-central division	26	24	5.77	8.04
Southern division	27	34	3.21	4.17
Means	100	120	4.26	5.44

The rainfall for July was, therefore, below the average for the whole island. The greatest rainfall, 37.66 inches, occurred at Moore Town, in the northeastern division, while 0.21 inches fell at Lunalio Asylum, in the southern division.

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Chart I. Tracks of Centers of High Areas. July, 1904.



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Chart II. Tracks of Centers of Low Areas. July, 1904.


Barkerville
Victoria
Seattle
Tacoma
Spokane
Portland
Walla Walla
Lewiston
Baker City
Roseburg
Eureka
Red Bluff
Sacramento
San Francisco
Fresno
Independence
Modena
San Luis Obispo
Los Angeles
San Diego
Yuma
Phoenix
Flagstaff
Santa Fe
El Paso
Pueblo
Denver
Grand Junction
Cheyenne
Salt Lake City
Boise
Helena
Kalispell
Havre
Miles City
Bismarck
Pierre
Rapid City
Valentine
Yankton
Sioux City
North Platte
Omaha
Lincoln
Concordia
Topeka
Dodge
Wichita
Amarillo
Oklahoma
Abilene
Fort Worth
Palestine
Taylor
San Antonio
Galveston
Port Eads
Corpus Christi
Brownsville
Matamoras
Tampico
Monterey
Mexico
Vera Cruz
Tuxpan
Progreso
Campeche
Havana
Cienfuegos
Puerto Principe
Santiago de Cuba
Grand Turk (Turks Isl'd)
Key West
Tampa
Jupiter
Titusville
Jacksonville
Pensacola
Mobile
New Orleans
Vicksburg
Shreveport
Meridian
Little Rock
Memphis
Fort Smith
Nashville
Chattanooga
Atlanta
Birmingham
Augusta
Macon
Montgomery
Columbia
Charleston
Savannah
Wilmington
Charlotte
Raleigh
Hatteras
Norfolk
Lynchburg
Roanoke
Richmond
Cincinnati
Evansville
Louisville
Lexington
Cairo
St Louis
Springfield
Kansas City
Columbus
Hannibal
Keokuk
Des Moines
Davenport
Chicago
Milwaukee
Green Bay
La Crosse
Dubuque
Minneapolis
Duluth
Moorhead
Marquette
Escanaba
Port Arthur
Winnipeg
Swift Current
Battleford
Prince Albert
Edmonton
Calgary
Kamloops
Tatoosh Island
Port Crescent
Port Townsend
Fort Canby
Astoria
Portland

Chart III. Total Precipitation. July, 1904.

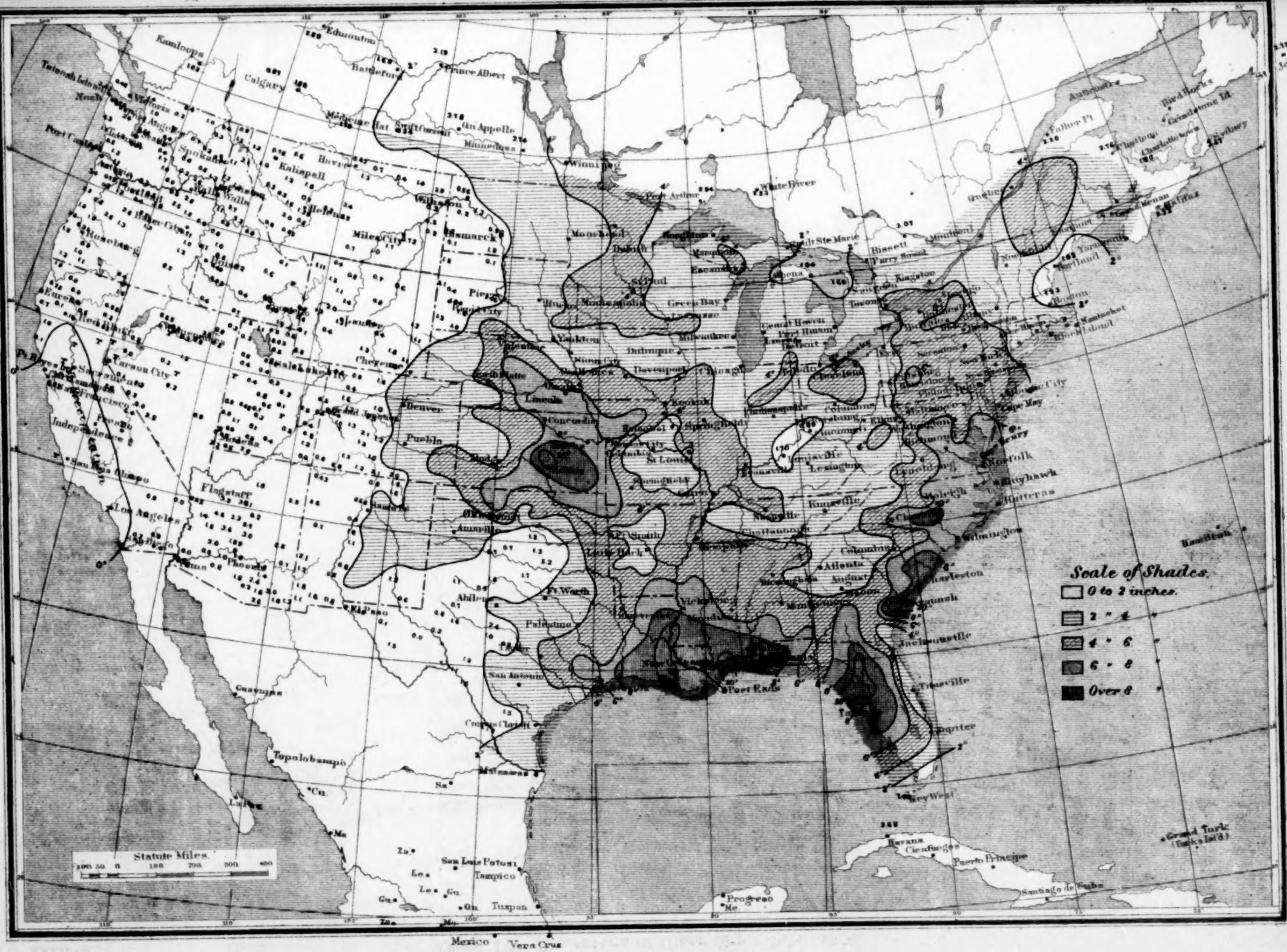


Chart IV. Percentage of Clear Sky. July, 1904.

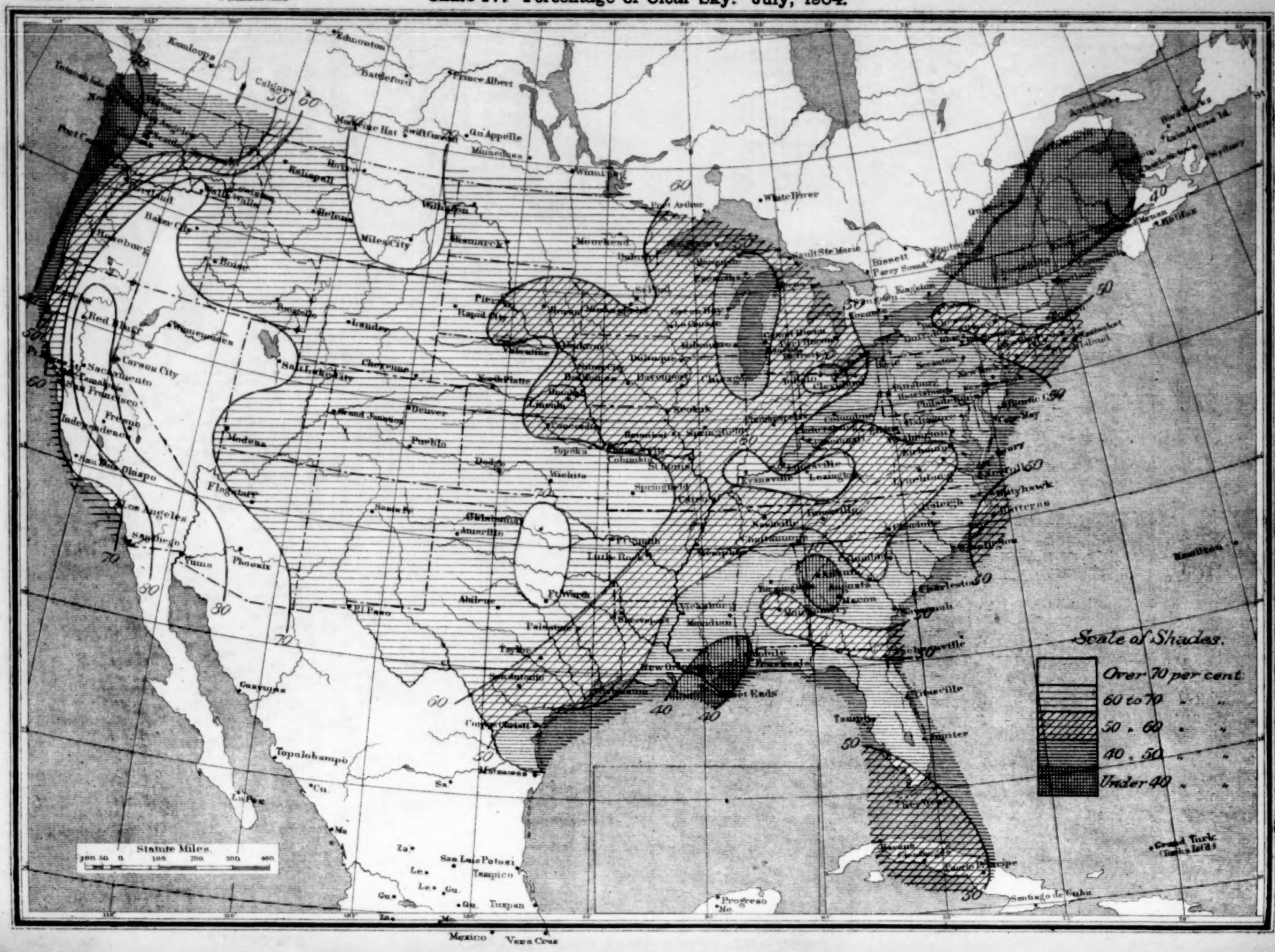


Chart V. Surface Temperatures: Maximum, Minimum, and Mean. July, 1904.

• Barkerville **Chart V. Surface Temperatures; Maximum, Minimum, and Mean. July, 1904.**



Chart VI. Isobars and Isotherms at 10,000 feet. July, 1904.

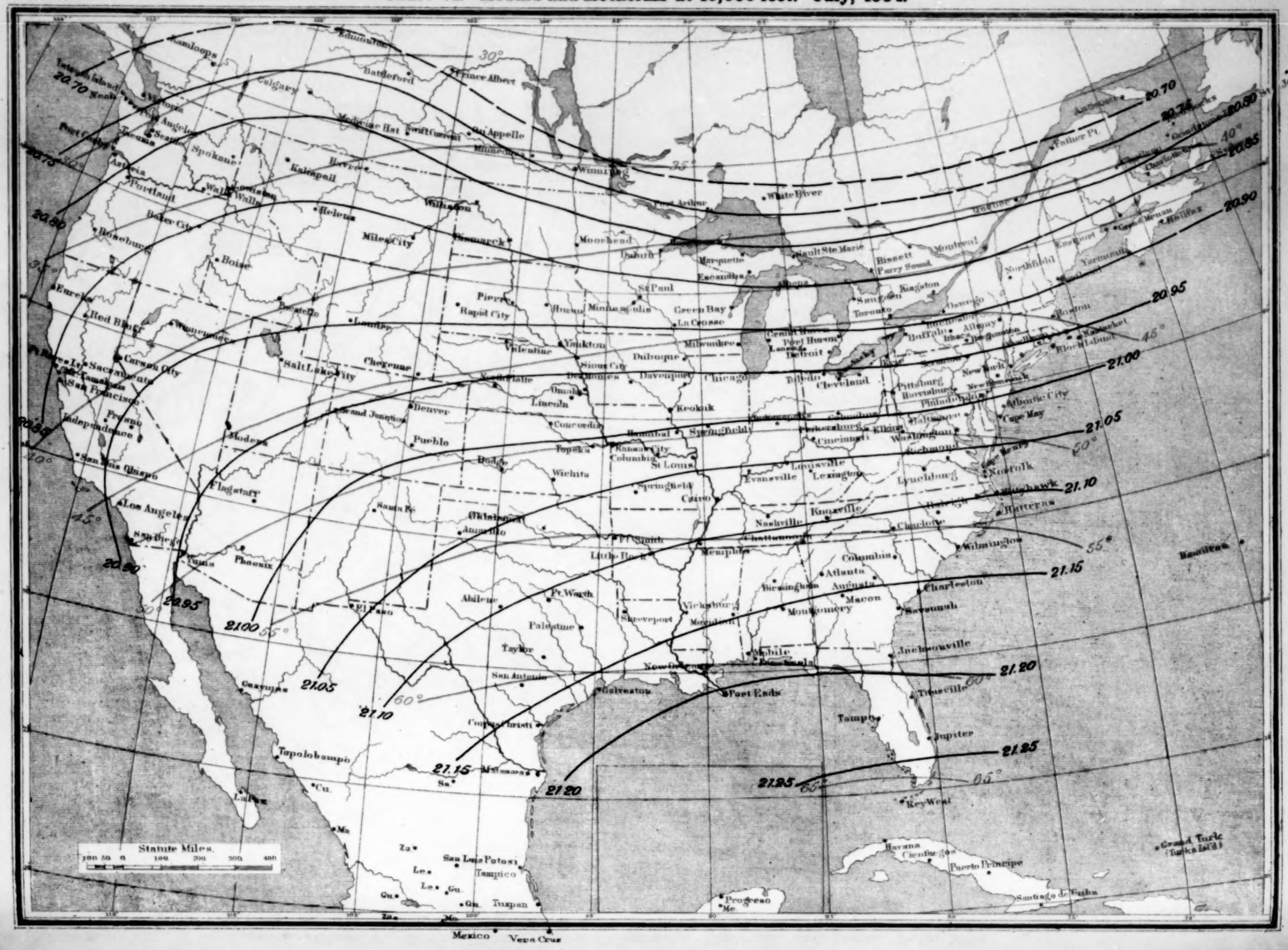


Chart VII. Isobars and Isotherms at 3500 feet. July, 1904.

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Chart VII. Isobars and Isotherms at 3500 feet. July, 1904.

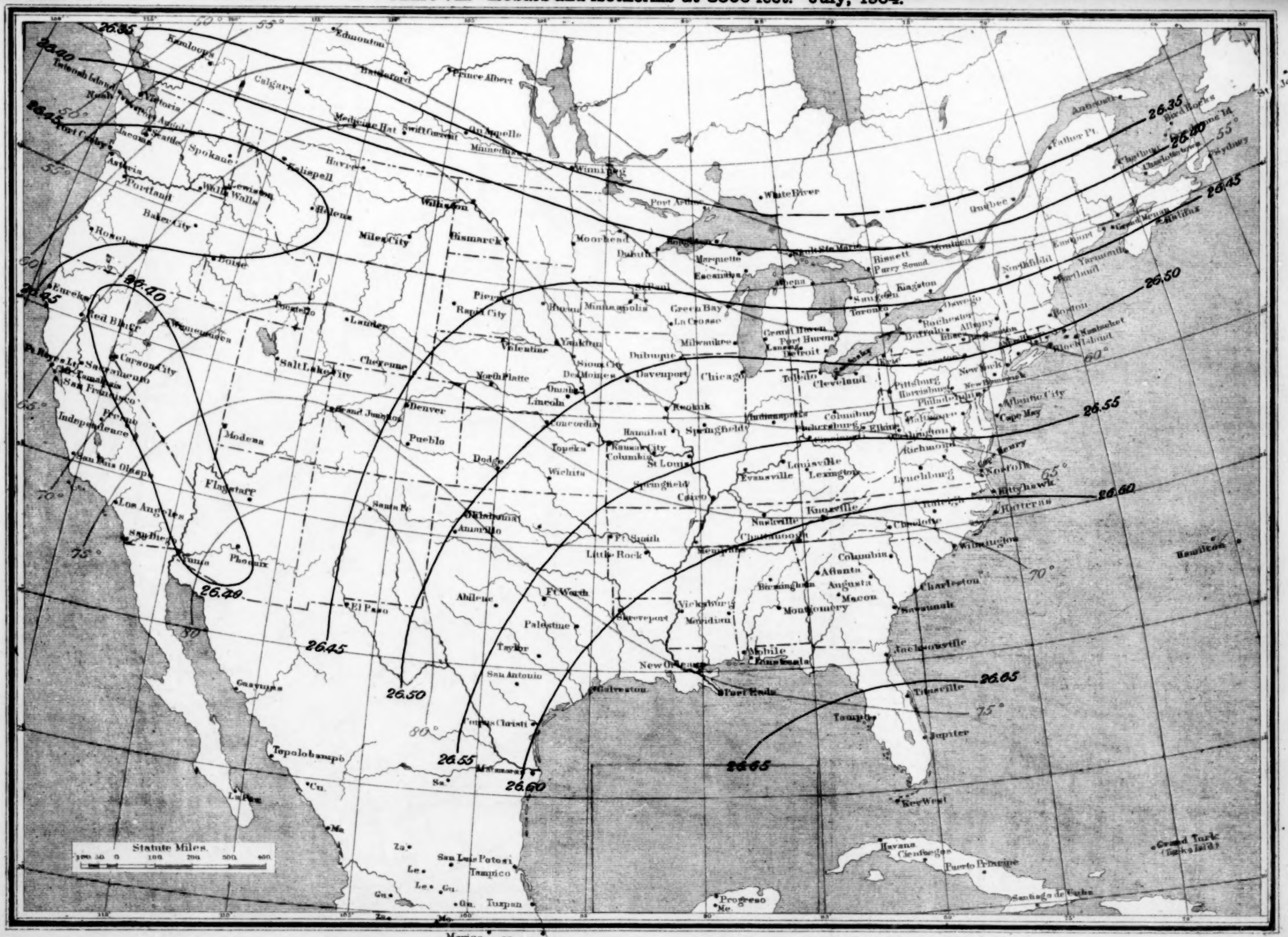


Chart VIII. Isobars and Isotherms at Sea Level; Resultant Surface Winds. July, 1904.

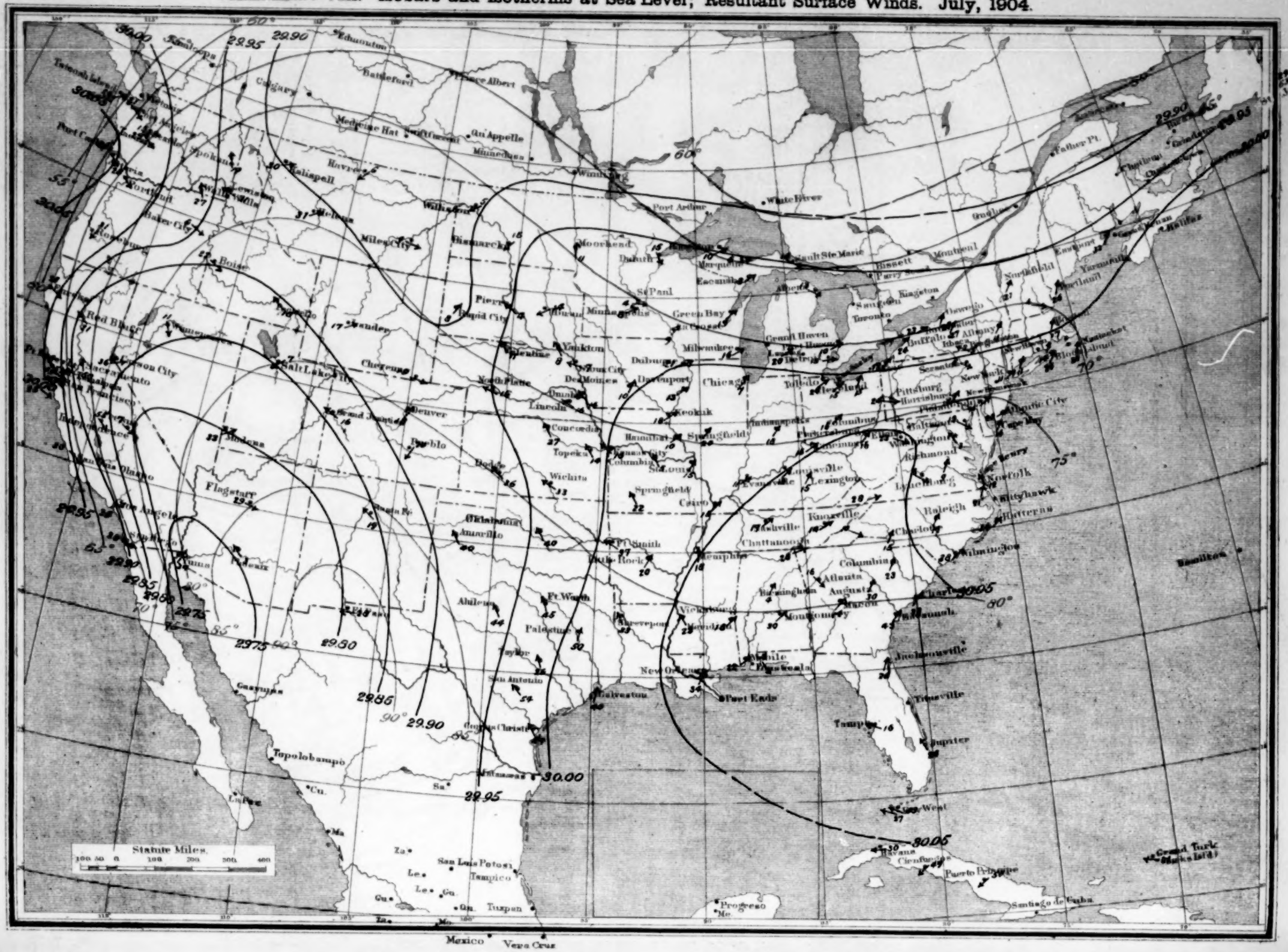


Chart IX. Sea-Level Isobars, Surface Temperatures, and Resultant Winds. July, 1904.

Chart IX. Sea-Level Isobars, Surface Temperatures, and Resultant Winds. July, 1904.

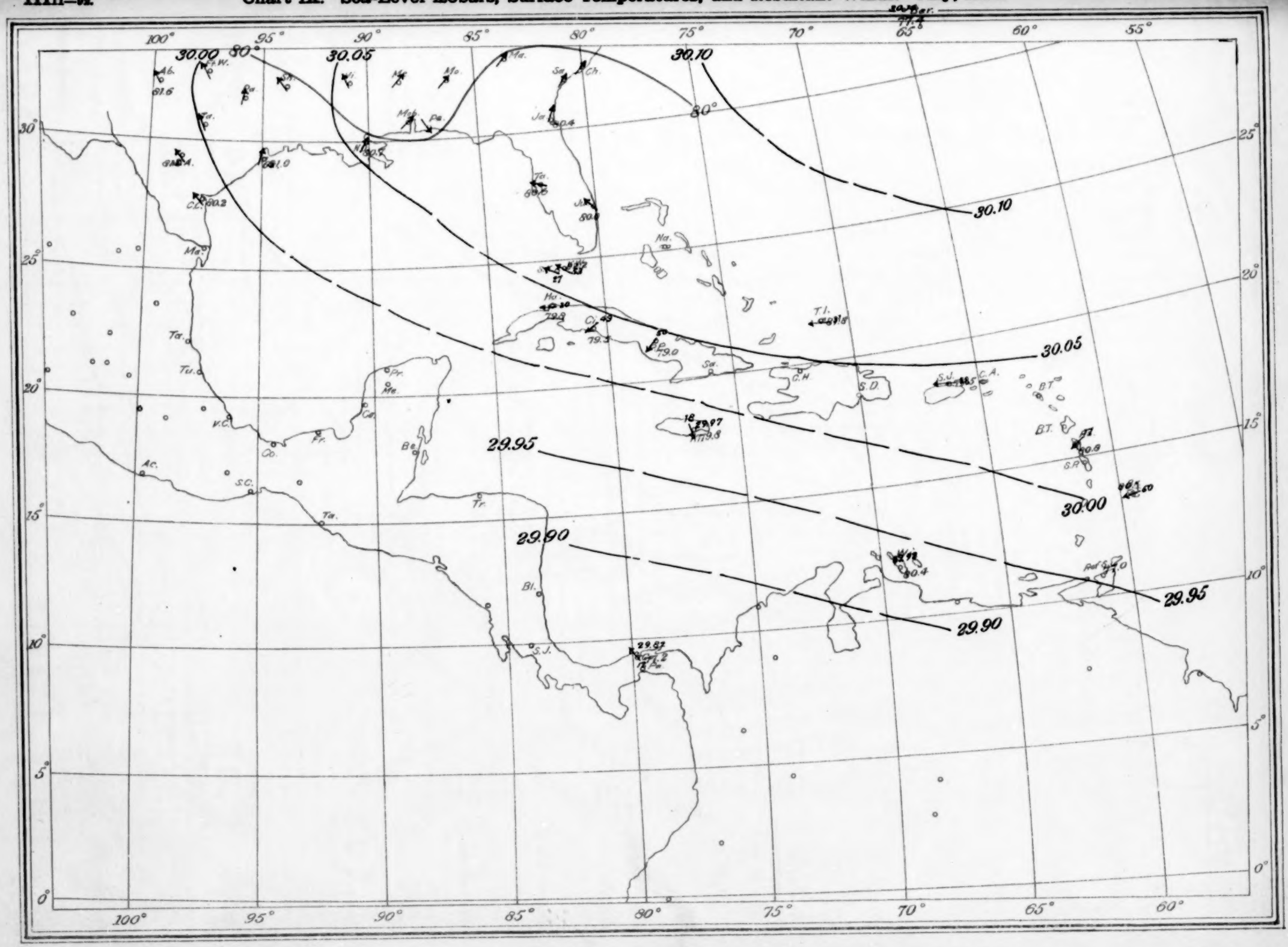


Chart X. Hydrographs for Seven Principal Rivers of the United States. July, 1904.

